The

Modern Sportsman's

Gun and Rifle.

Francis Peabody Magoun

Bedford

Massachusetts

Carlisle

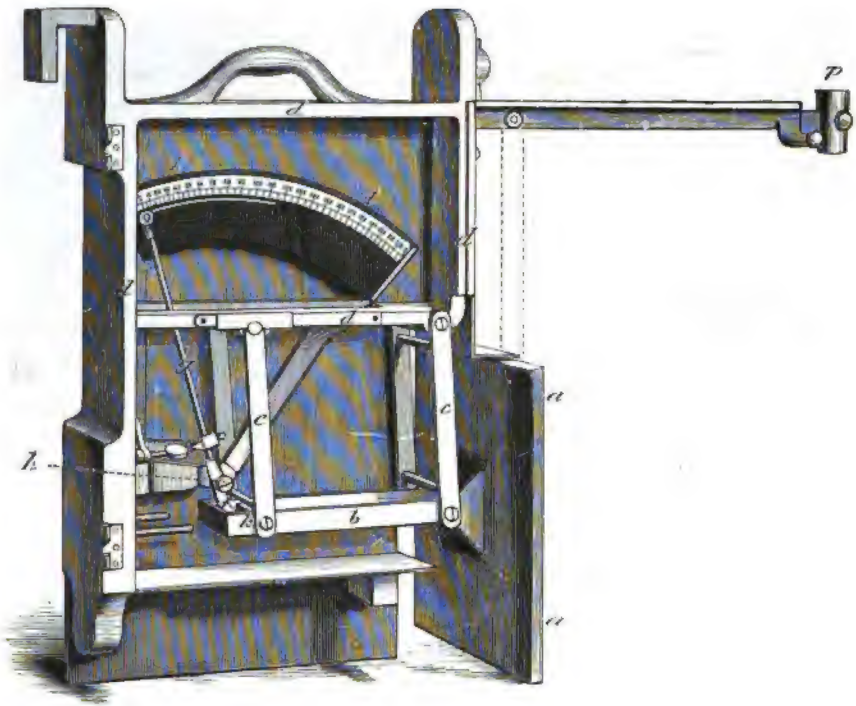
Massachusetts 1920

THE

# MODERN SPORTSMAN'S GUN AND RIFLE.

THE

# MODERN SPORTSMAN'S GUN AND RIFLE.



"FIELD" FORCE GAUGE.

*For description see page 36.*

**Frontispiece.**

o

THE

# MODERN SPORTSMAN'S GUN AND RIFLE;

INCLUDING

## Game and Wildfowl Guns, Sporting and Match Rifles, and Revolvers.

BY

J. H. WALSH ("STONEHENGE"),
EDITOR OF "THE FIELD."
AUTHOR OF "DOGS OF THE BRITISH ISLANDS," "THE GREYHOUND."
"BRITISH RURAL SPORTS," ETC.

IN TWO VOLUMES.

VOL. I.—GAME AND WILDFOWL GUNS.

LONDON:
HORACE COX,
"THE FIELD" OFFICE, 346, STRAND, W.C.

1882.

LONDON:
PRINTED BY HORACE COX, 346, STRAND, W.C.

# PREFACE TO VOL. I.

NEARLY a quarter of a century has elapsed since I first began, in my capacity as Editor of the *Field,* to examine into the merits of the varieties of the shot guns offered to the British sportsman. In the course of that long period, the muzzle-loader and the original Lefaucheux breechloader have in succession been abandoned; and now the improved hammered breechloader, which until 1879 held complete possession of the English market, is hard pressed by the hammerless plan of the same fundamental principle of closing the breech. The well-known black gunpowder, which was thought till within the last few years to be beyond improvement, has been to a great extent supplanted by Capt. Schultze's wood powder; and this comparatively modern invention is in its turn threatened by a new form of guncotton, recently patented and manufactured by the Explosives Company at Stowmarket. Soft lead shot has been obliged to succumb to a hardened alloy, and new methods of boring barrels and of loading the cartridges used in them have been devised, enabling the sportsman to have more complete control over his game than ever before. Lastly, and only within the

present year, brass cartridge cases have been produced of the same weight and price as paper, and there is reason to believe that the latter will be also placed on the shelf.

Concurrently with these improvements in the gun itself, the methods of trying its powers have been rendered more scientific, and chiefly by means of instruments which I have been able to devise. The sportsman can now ascertain in an hour the exact "figure of merit" of his gun, whereas a very few years ago it took him a whole season's shooting to do so.

At first sight it may appear presumptuous in the author of this book to publish it so soon after the appearance of "The Gun and its Development;" but it must be borne in mind that men actively engaged in business like Mr. Greener, have so concentrated their attention on their own improvements that they overlook what others are doing around them. This explains the otherwise unaccountable fact that, in conversing even with the most skilful gun-makers of the day, I often find that, though I cannot compete with them in knowledge of their own works, I am far ahead of them in my comprehension of the works of their rivals. In looking over the list of recent inventions mentioned by Mr. Greener, and comparing it with mine, it will be seen that a considerable number have either been entirely overlooked or erroneously described in "The Gun." To some extent the omissions are due to the date of its publication; for which reason the hammerless actions of Messrs. Purdey, Grant, Charles Lancaster, Webley,

Leeson, and Rogers, are not to be found in it, for all of these have been invented since that time; but this explanation will not serve in the case of several other makers of high reputation, whose inventions are either passed over with such a cursory notice as to be unintelligible, or are described erroneously. In this list may be included Messrs. Scott and Sons, Rigby and Bissell, Lang, Woodward, J. and W. Tolley, Powell, and lastly, though not least, Messrs. Gibbs and Pitt, whose well-known action is extensively sold both in London and the provinces. In addition to this long list I may mention that, while Mr. Greener has occupied his pages with a description of several wildfowling guns of his own make, he has omitted all mention of the celebrated punt guns made by Messrs. Holland and Holland, and Messrs. J. and W. Tolley, as well as the heavy shoulder guns of those firms and of others of somewhat lesser note.

But while these remarkable omissions may be said to justify the undertaking of my present task, the author of "The Gun" has so completely and exhaustively worked out its history that I have felt there was no room for improvement in that respect; and I have therefore not attempted to write any account of the gun earlier than 1868, when I first took up the subject in earnest. I must accordingly refer those of my readers who are interested in this department to Mr. Greener's book, in which they will find it treated in the most masterly manner.

I cannot conclude this preface without tendering my cordial thanks to the members of the gun trade generally,

who have, with a single exception, placed the contents of their establishments at my service. I must also express my high appreciation of the scientific labours of the gentleman signing himself "T.," whose most interesting letters I have republished from the *Field* with his permission, and with considerable additions kindly made by him. Nor must I forget to acknowledge the services of Mr. Butterworth, whose drawings and engravings of modern guns and their component parts have, I think, never been equalled.

The extent of the investigation into which I have been led is so great that I cannot flatter myself with even the hope that I have escaped many mistakes; but wherever I have fallen into one it has not been either from carelessness or a desire to mislead my readers, as a proof of which I pledge myself to make any necessary corrections which may be brought to my notice in another edition, if the public shall so far approve of my labours as to call for one.

J. H. WALSH ("STONEHENGE").

THE CEDARS, PUTNEY,
*Nov. 1st*, 1882.

# CONTENTS.

## BOOK I.

### The Shot Gun used with Game.

#### CHAPTER I.



#### CHAPTER II.



#### CHAPTER III.

Trials of the Gun.



#### CHAPTER IV.

Construction of the Gun.

## CHAPTER V.



## CHAPTER VI.

### THE HAMMERED BREECHLOADER.



## CHAPTER VII.

### THE HAMMERLESS BREECHLOADER.



## CHAPTER VIII.

### CHOOSING A HAMMERLESS GUN.

## CHAPTER IX.

### Cartridge Cases for Shot Guns—other than Punt Guns.



## CHAPTER X.

### Explosives used in Shot Guns.



## CHAPTER XI.

### Shot.



## CHAPTER XII.

### Wadding.



## CHAPTER XIII.

### Loading Cartridge Cases.

## ERRATA.

Page 72 and 73, under 20-bore, *for* "1⅛oz." *read* "⅞oz. shot."
,, 96, line 9, *for* "stab" *read* "stub."
,, 158, line 8, *for* "*d*" *read* "*b*."
,, 279. Mr. Greener's letter, dated July 5 (see p. 282), should have been placed before that of July 12 (see p. 280).
,, 209, last line, *for* "King William-street" *read* "Queen Victoria-street."
,, 211, last line but one, *for* "1872" *read* "1882."
,, 217, line 13, *for* "1872" *read* "1882."

THE

# MODERN SPORTSMAN'S GUN AND RIFLE.

## BOOK I.

## THE SHOT GUN USED WITH GAME.

### CHAPTER I.

### DEFINITION OF THE SHOT GUN.

The shot gun used by the sportsman usually consists of two smooth metal tubes about thirty inches long, closed at one end and joined together by brazing and soldering, or by soldering only, in such a way that when fired from the shoulder at an object forty yards from it, the centre of each charge shall strike it. To effect this, if the tubes are side by side, it is found that the long axis of each must not be parallel with its fellow, but they must converge to the extent of about one-eighth of an inch in their length. The reason of this tendency to shoot away from the central line is that each barrel recoils when discharged, and, its axis being about half an inch from the centre, where it is supported by a yielding body (the shoulder), the tube is thrown slightly to the right or left, as the case may be. This is corrected by the convergence of the barrels, and it is fortunate that the

correction is required because the breech ends, being necessarily thicker than the muzzles, the latter would otherwise require to be kept separate in proportion, which would have an ugly effect. Until I had demonstrated the possibility of shooting a double-barrelled gun from a machine rest, so that both charges should strike the same point, it was generally considered to be beyond the range of mechanical skill; but, by imitating the yielding nature of the shoulder by means of an ash frame, I was enabled, while using such a rest in the Field Trials of 1878, to eliminate the objection which had up to that time been inseparable from all such competitions, consisting in the impossibility of separating the skill of the shooter from that of the maker of the gun. It was alleged that certain gunmakers or their assistants could do more at the target than others, each using the same guns and ammunition, and the fact was generally admitted; so that unless one man could be found to shoot all the guns, and that man could be proved to be beyond the suspicion of partiality, a thoroughly fair competitive trial of guns was out of the question. In obtaining the latter of these two essentials, there would be no doubt great difficulty; and, even if such a man could be found, his impartiality would still be questioned. But in a long trial, extending over several consecutive days, no man's nerve and muscle could be depended on, and on that account, therefore, it was always found necessary to choose the lesser of two evils, and allow each competitor to shoot his own gun.

With a knowledge of these difficulties in the way of a fair trial of guns, I determined to make a series of experiments prior to the trial of 1879, and fortunately hit upon the right principle by imitating as nearly as possible the elasticity of the human body when its muscles are rendered rigid by the will. The result was the construction of the machine rest, which I have always since that time used in the trials which I have carried through; and though at first gunmakers were

incredulous, after giving it a fair trial they all admitted its superiority over the shoulder. Where the barrels are fixed one on the other, it is necessary to put them together in nearly parallel lines, as the support of the butt of the stock is so deep as not to admit of any variation of the line of fire depending on the slight difference between them as measured from the centre of the stock. They must, however, still be brought together slightly, though not nearly to the same extent.

But it is necessary to fix these barrels in a wooden stock, so that they may be handled with ease, and that a tolerably broad base may be given to enable the shoulder to which it is held to bear the recoil arising from the explosion of the charge. In this stock is let a lock for a single gun or a pair for a double-barrelled one, by which a blow is given when its trigger is pulled in order to fire the charge by detonation.

Such are the component parts of the gun in their most simple form. We have next to consider the variations of them which the sportsman requires for his several purposes.

# CHAPTER II.

## REQUIREMENTS OF THE SPORTSMAN'S GUN FOR HIS VARIOUS PURPOSES.

---

When it is considered that the shot-gun is wanted to kill animals varying in size from that of the humming-bird to that of the roe-deer, and that in some sports it must be carried all day, while in others the sportsman is at perfect rest, except when moving from one ambush or resting-place to another, it is clear that the same kind of gun will not be the best for all purposes. Again, in some cases it is desirable that the gun shall be reloaded as quickly as possible, while in others such a requirement is of little or no consequence. So also the killing distance is to be considered, for it is clear that a gun is comparatively useless if it will not kill at the distance within which it can be aimed at its quarry. Lastly, the skill and muscular power of the individual must be known before deciding on the charge of powder and shot best suited to him, and on the amount of spread to be given to the latter. For instance, one man can shoot fourteen drams of powder with impunity, while another complains if he has to bear the recoil of more than three drams. So with regard to the spread of the shot: if the shooter aims correctly, allowing for distance, flight, wind, &c., a much smaller killing circle will suit him than if his aim is likely to be a foot or two at least from the proper direction. Hence, while it is by general

consent fixed that the charge of shot shall be as nearly as may be concentrated within a thirty-inch circle at forty yards in guns used for game by the average sportsman, it is known that very good shots can perform well with a smaller circle, and that bad ones can do nothing unless it is increased. Now, the charge of shot must be limited by the bore of the barrel in which it is used, for it is manifest that a 20-bore cannot shoot so large a charge as a 12, there being no limitation as to weight in either case. Assuming, therefore, that the game to be killed is fixed, the next thing to be considered is the proper amount of spread to be given to the shot in order to insure its being killed with reasonable certainty by the individual about to use the gun. In the days of Joseph Manton there is no reason to suppose that sportsmen were better shots than they are now, and yet he advised his customers to use 20-bores, and even guns of smaller calibre. Now before the invention of the "choke," a 20-bore which could put more than 110 pellets of No. 6 shot into a 30-inch circle at 40 yards, was a *rara avis*, and yet we know by experience at the target, that even with 200 pellets in that circle there are always several triangular spaces left bare of shot measuring from six to nine inches from angle to angle. When I first investigated the merits of the "choke bore" Mr. W. W. Greener, who brought it to my notice, alleged that he could always insure the absence of such spaces, and it was not until the matter was tested by experiment, in his presence, that he would admit his failure. Now if such large spaces, through which a partridge or even a pheasant could escape, are left in patterns of 200 to the 30 inch circle, what would be their chance with 110 pellets, as in Joe Manton's guns? I believe, however, that the demand for a closer pattern now, as compared with his day, depends greatly on the increased wildness of game, and that the Joe Manton guns were used at a twenty or twenty-five yards range instead of thirty-

five or forty, as is now required. In any case the modern gun must be regulated at forty yards, and such is always done, and by common consent with No. 6 shot, containing about 270 pellets to the ounce—or in round numbers 300 pellets in the charge of 1⅛oz. generally adopted in the 12-bore. Two-thirds of this charge are, therefore, concentrated more or less regularly in the 30-inch circle, if the pattern is 200, the remainder being either so much depressed as to fall short of that distance or irregularly scattered outside the circle. The usual charge of a 20-bore is ⅞ of an ounce, which in No. 6 will only number 235 pellets; and, assuming that the same proportion will be outside the circle, as in the 12-bore, the pattern would be about 155, which is between that of Mr. Green's winning gun in the last trial (150·72) and that of the second (183·30), which, however, gave much less penetration, being shot with only 1¾drs. of powder against Mr. Green's 2drs. *Cæteris paribus*, therefore, in point of pattern the 12-bore has greatly the advantage over the 20-bore, while in penetration it also holds a superiority, though not to the same extent.

It appears, therefore, that the game-shot, taking into consideration that with the aid of the choke any pattern up to 230 or 240 can be obtained, and by smaller bores in proportion down to 150 with the 20-bore, has to select that which will best suit his own skill and muscular power, and with this he should demand a more or less high penetration, according to the particular sport for which it is designed. In addition to these essentials he will in these days choose a breechloader, loading at the muzzle being now quite out of the question. Next he will look for safety under all circumstances, handiness in use, and freedom from more "wear and tear" than is compatible with it, specially including that arising from the admission of water and gas to the action and locks. Lastly, he will demand reasonable facility in cleaning and oiling the

locks, action, and barrels. These essentials are more or less required in the various kinds of sport as we shall presently see.

## SECTION I.

### Essentials for the Gun used in the Open.

Open shooting may be mainly divided into three kinds, irrespective of wildfowl shooting—viz.: first, grouse shooting; second, partridge shooting; and, thirdly, snipe shooting.

In grouse shooting as much penetration as can be obtained is important, because this bird requires to be hard hit before he will fall; and, moreover, except very early in the season, he is not often shot at much under forty yards. He is also a fast flyer, and unless the shooter is a practised hand the killing circle should be of full size. But in walking over moors after grouse the weight of the gun is a consideration, so that it is often expedient to use one of inferior killing power which can be carried without fatigue, in preference to one which would soon tire the arms and render them incapable of taking a steady aim. An ordinary hammered breechloader can be loaded and fired twelve times in the minute, and this kind of gun will therefore suffice in point of rapidity of loading, in which it is only slightly excelled by the modern self-cocking hammerless gun. There are also very few hedges met with, so that a gun provided with a rebounding lock may be carried at full cock with safety under ordinary circumstances. Should a hammerless gun be selected, it ought to be provided with a safety bolt on the triggers, and also an intercepting bolt to lock the tumblers in case the scear is jarred out of the bent either in loading the gun or by a fall or blow.

For partridge shooting a very similar gun is required, but it need not be quite so hard a hitter, as this bird is not so tenacious of life as the grouse. Hedges are also much more frequent, and it is still more necessary to guard against the trigger being accidentally pulled, as well as against the scear being jarred out of the bent. The rebounding lock provides against these accidents if properly made, but if the scear-spring is weak, or the half-cock bent is too shallow, it is possible to pull the hammer nearly to full-cock by a twig in passing through a hedge, and for it to fall past the half-cock bent and explode the cap. Still such an accident is not likely to occur, but that it has occurred is stated on reliable authority. With regard to hammerless guns, the same precautions are necessary as in grouse shooting.

The snipe is a bird which demands complete control over the gun before he can be hit with reasonable certainty, his twists being very rapid and eccentric. There is also a good deal of fatigue attending on the sport, and, consequently, though a large killing circle is *primâ facie* necessary, yet there is no case in which it is more expedient that the shooter should not be overloaded with weight. A strong man will of course do best with a 12-bore, but a weak one will probably find that though his killing circle is reduced he will bag more snipe with a 16 or 20-bore. In other respects the same precautions are to be used as in partridge shooting, demanding attending to safety bolts, &c.

## SECTION II.

### The Desiderata in the Gun for Pheasant Battues, and Covert Shooting either of this Bird or Woodcocks.

Pheasants are now so rarely shot over dogs, that it is scarcely necessary to allude to the gun required for that kind of sport formerly regarded as almost, if not quite, equal to shooting in the open. Occasionally the "spring falls" of a covert are beaten either before or after the other parts are driven, but it is seldom that a whole day is given up to pheasant shooting, either in spring falls or in the small spinneys in which this bird delights to breed and roost until driven into the large adjacent coverts, either by nature or art. A gun specially constructed for this sport is therefore seldom demanded, but if it is, the chief consideration is that the barrels shall be somewhat shorter than when wanted for open shooting, to avoid overhanging branches which sometimes get in the way of the muzzle. Some go so far as to require them reduced to twenty-four or twenty-five inches, but the average length may be fixed at twenty-eight inches in lieu of thirty.

But there is an old-fashioned kind of covert sport which is still pursued with as much zest as ever, and which demands a gun similar in make to that I have just described. I allude to cock-shooting, which hitherto has baffled all attempts at modernisation, and requires the same short handy gun as the pheasant when pursued in the same way. Short barrels and rebounding locks with hammered guns, and similar barrels with good safety bolts for hammerless guns, may therefore be regarded as *desiderata* where a special gun for either or both of these kinds of covert shooting is required.

But for pheasant *battues* something more is necessary. Here rapidity of loading comes to be regarded as a *sine quâ non*, and not only must the *battue* gun be a rapid loader, but in order that it may have time to cool, a second must be provided, which is exchanged for the first when the latter is discharged, by a servant who is called a "loader," and after every shot a similar exchange from one to the other goes on. The first *desideratum* in this kind of gun is that it shall kill, for here each sportsman is competing with several others, and unless he kills his birds clean and well, he will not again be asked to take part in subsequent *battues* on the same ground; and not only that, but his bad shooting will soon be so generally known, that he will be excluded elsewhere. There is little walking in this sport, and that little is done with the guns on the loader's arms, so that weight is no object, and the 12-bore is almost universally adopted, more or less choked to meet the skill of each marksman. The length of barrels may be 30 inches without much chance of any overhanging branches interfering with the aim, but many good sportsmen prefer barrels of 28 inches for the *battue*. Next to killing power comes in rapidity of loading, and here the hammerless gun has no rival, because it is always cocked while the process of opening and closing the action is going on, and this saves the time required for cocking in hammered guns. But not only is this kind of gun more suited for *battues* than its predecessor and rival in this point, but it is also more safe *provided that it has a sufficient bolt* to take the place of half-cock. Numberless accidents have occurred in letting down the hammer from full to half-cock, in consequence of its slipping out of hand owing to carelessness, awkwardness, or cold; but the safety bolt of the hammerless gun, if properly constructed, is not liable to the same danger, and therefore is to be regarded as tending to eliminate it. By a *sufficient* safety bolt I mean one which not only bolts the triggers

automatically, but also the strikers, either by means of an intercepting block or a bolt into the tumbler or striker. I do not consider the bolting of the triggers alone sufficient, for the simple reason that the gun is always liable to a shock while being closed, as well as to blows and falls by which it is possible to jar the scear out of the bent in the tumbler, and thereby produce a discharge while in the hands of the loader—the shot probably going into his master's body. There are also intercepting bolts which are dangerous from being liable to give a blow when let down, after having so far proved their efficiency. That is to say, the trigger has been pulled while the bolt was at "safety," and the intercepting bolt has caught the tumbler and arrested the blow. The shooter is of course vexed at the *contretemps*, and in his hurry pushes the bolt to the position for firing, by which the striker is let down on the cap, and in this way an explosion has frequently taken place. A safety bolt therefore, to be, in my opinion, sufficient, must not only intercept the tumbler in such a way that it cannot be afterwards let down, but must also bolt the triggers, for when they are thus bolted it is never called into action unless the scear has been jarred out of bent. Moreover, in a gun thus provided, if the shooter has attempted to pull the trigger while at "safety," there is no necessity for opening the action to recock the gun, as is the case when an intercepting bolt is relied on without the trigger bolt.

## SECTION III.

### The Gun required for Driving.

For driving, whether of grouse or partridges, a very hard-hitting gun must be selected, as both of these birds come at a great pace towards the shooter in ambush, and must be met

by shot travelling with proportionate velocity if good work is to be done, for with a low one the shooter has to make a greater allowance, which increases the difficulty of taking a correct aim. Weight is not of much consequence in this kind of shooting any more than in the *battue*; indeed, many good shots prefer a moderately heavy to a light gun for driving, and a 12-bore of 7½lb. weight is selected on the average. As to the choice between hammered and hammerless guns it is quite a matter of fancy; but, like the *battue*, in driving, a loader with a second gun is always provided, so that the precautions against an accidental discharge necessary in the one case are applicable to the other.

## SECTION IV.

### The Pigeon Gun and its Essentials.

The same gun which is suited to *battue* shooting and driving is also required for this kind of sport; but, as the gun is not handed to the shooter in haste by the loader, there is not as much danger of an accidental discharge while loading, and the demand for an intercepting bolt, if a hammerless gun is used, is not quite so imperative. Indeed it has so often happened that a safety bolt has been locked at the time of "pulling," and the bird thereby lost, that I can excuse the demand which has so often been made for a gun without any bolt at all, though manifestly it is not justifiable. For a moment's consideration must satisfy every impartial person that the pigeon shooter who is so nervous that he cannot depend on himself to unbolt his gun when he goes to his distance, has no business in such a competition, either on the score of his own chance of success or on that connected with the safety of his friends. If he is so flurried as to be beyond control, no one near him is safe when he has a gun in his

hand, and he is far better at home; while, if he is not flurried, he will soon learn to look at his bolt before he cries "pull."

Having thus carefully investigated the *desiderata* in the gun as used in the above varieties of sport, I shall next consider the best means of testing guns, first as regards safety by means of what is called "proof," and next for performances by shooting them at the target, which in a few hours will give more reliable information as to their respective merits than a whole season's trial in the field.

# CHAPTER III.

# TRIALS OF THE GUN.

## SECTION I.

### Trial of Safety by what is called "Proof."

Up to the year 1868 two companies controlled the sale of guns in England, one of which ("The London") had obtained a royal charter in 1637, the other ("The Birmingham") dating from 1813, when they obtained an Act of Parliament, which was amended in 1855. This contained provisions by which all guns sold in England must be proved either in London or Birmingham, but the conditions were left to the two companies, and in practice it was found that these differed materially, the London proof being the more stringent of the two.

In 1868 an Act was passed in which the same scale of proof was laid down for both companies, and since then, although there has been a general impression that the London proof is the more reliable, there is no foundation for that belief. By the 117th section of the above Act, "The two companies from time to time, should they deem the proof insufficient, or inapplicable, or unsuitable, on application to and with the approval of Her Majesty's Principal Secretary of State for the War Department, may repeal or alter all or any of the rules and regulations, and all or any part of the scales respectively from time to time in force under this Act for the proof of small arms;" and acting under it they have, since the introduction of "choke

boring" (viz., in 1875), substituted No. 6 soft shot for ball in proving barrels so bored, the charge being of the same weight as the ball. The marks denoting this proof differ from those for cylinders as follows: The letters and numbers denoting the gauge shall be B, followed by the figures denoting the diameter of the bore at the widest part of its breech end, in front of the chamber; and M, followed by the figures denoting the diameter of the bore at the muzzle. These letters and figures are to be followed by the words "choke" or "not for ball," according to the kind of choking, and preceded by the same stamps for the respective companies as are used for cylinders. With this exception the Act as passed in 1868 (31 & 32 Vict. c. cxiii.) remains in force.

The Act itself mainly consists of sections relating to the management of the two companies, which are of little interest to the general reader, with the exception of the following:

Section 110 enacts that—

Every double barrel provisionally proved according to the recited Act or this Act, and at any time thereafter reduced in strength in any progressive stage of the manufacture thereof, shall for the purposes of this Act be deemed an unproved barrel, except for the purpose of receiving and until it shall have received the definite proof.

The intention here is that after proof no reduction of strength shall be made; but as the stamp is only on the breech, and there only on one side, it is impossible to prevent the practice, which is very frequent, of cutting away more or less of one side of each barrel where it comes in contact with its fellow, and still further reducing its strength by boring a hole between the two for the extractor. To lessen the weight also, which is a very common *desideratum* with purchasers, the barrels between the breech and muzzle are filed down, and this often to such an extent as to make them absolutely

dangerous, even with ordinary charges. This ought to be prevented by some means, at all events as far as the definitive proof is concerned, after which no reduction of weight should under any circumstances be allowed; and here the addition of stamped figures denoting the weight of the barrels as proved would be sufficient, but I do not well see it is possible to apply this plan to the provisional proof mark which is affixed to each barrel singly, for there is afterwards a necessary reduction in putting them together and cutting away part of the metal for "the lump," while there is an addition of the rib and solder necessary for uniting them. A stamp at various definite points of the barrels, giving the external and internal diameters at these points, has been suggested, but the barrels are too thin, except at their breech ends, to bear such a process, and it is therefore quite out of the question. Moreover, the definitive proof is quite sufficient to provide for safety if the barrels remain intact, and I should be quite satisfied with a stamp denoting the exact weight as proved. The same remark applies also to the action, which is only stamped on the part where it meets the stamps on the barrels, and may be afterwards reduced in any other part, and no doubt such reduction is often done. The addition of figures denoting the weight of this part of the gun, which should be carefully defined by the companies, would meet the difficulty in the same way as with the barrels, and would greatly add to the efficiency of the proof. At present several ounces may be taken away from the barrels and action after definitive proof without detection, although no doubt a skilled "viewer" will suspect that the fraud has been committed.

Sections 111 and 112 are also intended to prevent the above frauds, but they are wholly inoperative, as it is easy to effect the reduction without touching the proof marks.

111. If any barrel which shall be marked as proved under the recited Act or this Act shall by any process of manufacture, or by

any other means whatsoever other than the user and wear and tear thereof, be unduly reduced in substance or strength so as that the mark thereon does not duly represent the proof which if then duly proved it would bear, every such barrel shall for the purposes of this Act be deemed an unproved barrel.

112. Except as hereinafter provided with respect to the removal of provisional proof marks or converted barrels, if any barrel marked as proved under the recited Act or this Act have at any time the mark of such proof removed therefrom or altered, or so defaced as not to be distinguishable, or cut, severed, or removed from such barrel in any process of manufacture, or by any other means whatsoever other than the user and wear and tear thereof, every such barrel shall for the purposes of this Act be deemed an unproved barrel.

Section 132 has reference to barrels of foreign manufacture, and enacts that—

Every barrel of foreign manufacture, having duly and lawfully impressed thereon the due and proper mark, sign, or character indicative of the due proof thereof at any foreign proof house, the marks whereof shall be entered in and correspond with the register of foreign proof marks kept at the proof house of either of the two companies, shall be exempted from the provisions of this Act: Provided always, that if any barrel so exempted shall on any part thereof, or on any part of any small arm into which it is made up, be stamped or marked with any mark, name, sign, or character indicating or purporting to indicate that such barrel or small arm, or any part thereof respectively, is of English manufacture, or shall bear the name of any English maker or dealer, or of any person, partnership, or company carrying on in England the business of a maker of or dealer in small arms or barrels, such barrel shall for the purposes of this Act be deemed an unproved barrel of English manufacture.

Thus, when, as is often the case, Belgian barrels are used by English gunmakers, the Belgian proof mark will not be sufficient, and the barrels must be again proved in this country.

The following schedule is attached to the Act, by which the state of barrels, &c., precedent to proof is defined, and also

the various charges for the several gauges. At page 15 I have referred to the alteration necessary for choke-bored barrels:—

## SCHEDULE B.

### Rules and Regulations and Scales applicable to the Proof of Small Arms.

*Classification of Small Arms.*

First Class.—Comprising single-barrelled military arms of smooth bore, not being breechloaders or revolvers.

Second Class.—Comprising double-barrelled military arms of smooth bore and rifled arms of every description, whether of one or more barrels, or constructed of plain or twisted iron, not being breechloaders or revolvers.

Third Class.—Comprising every description of single-barrelled birding and fowling pieces for firing small shot, and also those known by the names of Danish, Dutch, Carolina, and Spanish, not being breechloaders or revolvers.

Fourth Class.—Comprising every description of double-barrelled birding and fowling pieces for firing small shot, and breechloading small arms of every description and system, not being revolvers.

Fifth Class.—Comprising revolving small arms of every description and system.

*Rule of Proof.*

The gunpowder used shall be of equal quality and strength with that which is now used or from time to time shall hereafter be used by Her Majesty's War Department.

The bullets used shall be of lead, and of the size and weight prescribed by the respective scales for proof; in shape, except bullets used for rifled arms, they shall be spherical, cylindrical, or conical.

The wads used, except wads used for rifled arms, shall be of felt, or cork, or paper, and shall not exceed in thickness the length of one diameter of the bore, one wad to be placed over the powder and the other over the bullet.

As to rifled arms of every description, the quantity of powder used for the first proof shall be three hundred per cent. and for the second proof two hundred per cent. of the service charge. The

bullets used shall be flattened projectiles of lead, and cylindrical, calculated on the specific gravity of lead being 11·352, and for the first and second proof they shall be one hundred and thirty-five per cent. of the service weight. The wads used shall be of solid felt or cork, and shall be in thickness the length of one diameter of the bore, one wad to be placed over the powder and the other over the bullet.

Barrels for arms of the second and fourth classes shall be proved provisionally and definitely, or, at the request in writing of the person or persons sending the barrels for proof, shall be proved once only, in which case such barrels shall be sent in the state for definitive proof, but shall be proved according to the scale of provisional proof, and shall be marked with a special mark denoting that such barrels have been proved in the definitive state according to the scale for provisional proof; and, subject as hereinafter mentioned, barrels for all other arms shall be proved once definitively; but nevertheless the scale used for proving such barrels for arms of the third class as have the diameter of the bore in every part one inch and a quarter or upwards shall be the provisional scale.

It shall be sufficient from time to time to prove all breechloading military barrels in the same manner as breechloading military barrels made for the use of Her Majesty's Forces, and with the same weight of gunpowder and the same description of cartridge as are now used or from time to time shall hereafter be used in the proof of similar barrels at the Government factory at Enfield.

As to any military barrel made for the use of Her Majesty's Forces, or for the late Honourable East India Company, which has ceased to belong to Her Majesty, but which bears, in addition to a proof mark authorised by Her Majesty's War Department, the letter O struck (prior to such cesser) over or upon the broad arrow or some part thereof by the said War Department, it shall, if it be a rifled barrel, be proved with definitive proof, or if it be a smooth bore barrel with half the charge of powder, but with the same weight of bullet which would be applicable to the proof thereof if such barrel were an unproved barrel under this Act, and after either such proof such barrel shall be marked as proved definitively; and as to any military barrel made for the use of Her Majesty's Forces, or for the late Honourable East India Company, which has ceased to belong to Her Majesty, and which does not bear, in addition to a proof mark authorised by Her Majesty's

War Department, the letter O or the letter S struck (prior to such cesser) over or upon the broad arrow or some part thereof by that department, it shall (whether it shall or shall not bear a proof mark authorised by that department) be liable to proof as an unproved according to its classification under this Act.

*Conditions precedent to Proof.*

Barrels for arms of the first class shall not be qualified for proof until they shall be in a fit and proper state for setting up, and the thread of the screws sound and full.

Barrels for arms of the third class shall not be qualified for proof until they shall be in a fit and proper state for setting up, with the squares set off looped, and the proper breeches in the thread of the screws sound and full: and all barrels lumped for percussioning shall be proved through the nipple with the proper pins or plugs in.

Barrels for arms of the second and fourth classes:

For provisional proof:—If of plain metal, shall be bored and ground having plugs attached, with touch-holes drilled in the plugs of a diameter not exceeding one sixteenth of an inch. Notches in the plugs, instead of drilled touch-holes, shall disqualify for proof. If of twisted metal, they shall be fine-bored, and struck up with proving plugs attached, and touch-holes drilled, as in the case of plain metal barrels.

For definitive proof.—The barrels, whether of plain or twisted metal, shall be smoothed in the finished state with the breeches in the percussioned state, huts filed up, bars of barrels intended for bar locks properly filed up on the top and bottom sides, the top and bottom ribs of double barrels shall be rough struck up, pipes, loops, and stoppers, on the proper breeches in the thread of the screws sound and full, and all rifle barrels shall be rifled.

Barrels for breechloading arms, all which are subject to provisional proof and to definitive proof, shall receive the latter proof after the breechloading action is attached and complete.

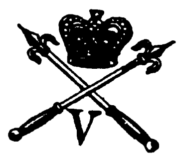
*Marks of Proof.*

The marks denoting definitive proof shall be the proof and view marks now used by the two companies respectively; (that is to say,)

As to the Gunmakers Company: The letters G P interlaced in a

cypher surmounted by a crown, and the view mark being the letter V surmounted by a crown (videlicet,)


As to the Guardians: Two sceptres crossed, a crown in the top angle formed by the crossing of the sceptres, the letter B in the proper right angle, the letter C in the proper left angle, and the letter P in the lower angle; and the view mark being two sceptres crossed, a crown in the top angle formed by the crossing of the sceptres, and the lower angle the letter V; (videlicet,)


The marks denoting provisional proof shall be as follows:

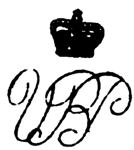
As to the Gunmakers Company: The letters G P interlaced in a cypher surmounted by a lion rampant; (videlicet,)

As to the Guardians: The letters B P interlaced in a cypher surmounted by a crown; (videlicet,)

The marks denoting provisional proof of barrels proved in the state for definitive proof shall be as follows:

As to the Gunmakers Company: The letters V G P interlaced in a cypher surmounted by a lion rampant; (videlicet,)

As to the Guardians: The letters V B P interlaced in a cypher surmounted by a crown; (videlicet,)



*Mode of affixing Proof Marks.*

On arms of the first, third, and fifth classes the definitive proof mark and view mark shall be impressed at the breech end of the barrel, and if the barrel be constructed with a patent breech or with revolving cylinders or chambers, the view mark shall be also impressed upon the breech, or upon every cylinder or chamber, if more than one, with which the barrel is connected.

On arms of the second and fourth classes proved provisionally and definitively the provisional proof mark shall be impressed at the breech end of the barrel, and the definitive proof mark and view mark shall be impressed upon the barrel above the provisional proof mark; and if the barrel be constructed with a patent breech, or with a breechloading action, or with breech blocks or chambers, the view mark shall be also impressed upon the breech or breechloading action, or upon each of the breech blocks or chambers, if more than one, with which the barrel is connected.

On arms of the second and fourth classes proved provisionally in the state for definitive proof, the proof mark shall be impressed at the breech end of the barrel, and if the barrel be constructed with a patent breech, or with a breechloading action, or with breech blocks or chambers, shall be also impressed upon the breech or breechloading action, or upon each of the breech blocks or chambers, if more than one, with which the barrel is connected.

On all barrels the gauge size of the barrel shall be struck at the definitive proof.

## SCALE FOR PROOF OF RIFLED SMALL ARMS OF EVERY DESCRIPTION.

| Number of Gauge. | Diameter of Bore. | Bullet for Proof. | | | | Charge of powder for | | | | Service Charge. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Diameter. | Length. | Ratio of Length to Diameter. | Weight. | First Proof. | | Second Proof | | Powder. | | Ball. |
| | inches. | inches. | inches. | | grains. | grs. | oz. drs. | grs. | oz. drs. | grs. | oz. drs. | grains |
| 1 | 1·669 | 1·649 | 2·474 | 1·500 | 15186·0 | 3417 | 7 13 | 2278 | 5 3¼ | 1139 | 2 9¾ | 11390 |
| | 1·500 | 1·480 | 2·220 | 1·500 | 10977·0 | 2470 | 5 10½ | 1646 | 3 12¼ | 823 | 1 14 | 8233 |
| 2 | 1·325 | 1·305 | 1·958 | 1·500 | 7527·1 | 1694 | 3 14 | 1129 | 2 9¼ | 565 | 1 4¾ | 5645 |
| | 1·250 | 1·230 | 1·845 | 1·500 | 6300·9 | 1418 | 3 3¾ | 945 | 2 2½ | 473 | 1 1¼ | 4726 |
| 3 | 1·157 | 1·137 | 1·706 | 1·500 | 4978·5 | 1120 | 2 9 | 747 | 1 11¼ | 373 | 0 13¾ | 3734 |
| 4 | 1·052 | 1·032 | 1·548 | 1·500 | 3721·6 | 837 | 1 14½ | 558 | 1 4½ | 279 | 0 10¼ | 2791 |
| | 1·000 | ·980 | 1·470 | 1·500 | 3186·9 | 717 | 1 10¼ | 478 | 1 1½ | 239 | 0 8¾ | 2390 |
| 5 | ·976 | ·956 | 1·434 | 1·500 | 2958·4 | 666 | 1 8¼ | 444 | 1 0¼ | 222 | 0 8 | 2219 |
| 6 | ·919 | ·899 | 1·349 | 1·500 | 2461·1 | 554 | 1 4¼ | 369 | 0 13½ | 185 | 0 6¾ | 1846 |
| | ·900 | ·880 | 1·320 | 1·500 | 2307·5 | 519 | 1 3 | 346 | 0 12¾ | 173 | 0 6¼ | 1731 |
| 7 | ·873 | ·853 | 1·280 | 1·500 | 2102·3 | 473 | 1 1¼ | 315 | 0 11½ | 158 | 0 5¾ | 1577 |
| | ·850 | ·830 | 1·245 | 1·500 | 1936·1 | 436 | 1 0 | 290 | 0 10½ | 145 | 0 5¼ | 1452 |
| 8 | ·835 | ·815 | 1·223 | 1·500 | 1833·7 | 413 | 0 15 | 275 | 0 10 | 138 | 0 5 | 1375 |
| 9 | ·803 | ·783 | 1·175 | 1·500 | 1626·1 | 366 | 0 13½ | 244 | 0 9 | 122 | 0 4½ | 1220 |
| | ·800 | ·780 | 1·170 | 1·500 | 1606·8 | 362 | 0 13¼ | 241 | 0 8¾ | 121 | 0 4½ | 1205 |
| 10 | ·775 | ·755 | 1·132 | 1·500 | 1456·6 | 328 | 0 12 | 219 | 0 8 | 109 | 0 4 | 1092 |
| | ·770 | ·750 | 1·126 | 1·501 | 1429·7 | 322 | 0 11¾ | 215 | 0 7¾ | 107 | 0 4 | 1072 |
| | ·760 | ·740 | 1·112 | 1·503 | 1374·6 | 310 | 0 11¼ | 207 | 0 7½ | 103 | 0 3¾ | 1031 |
| 11 | ·751 | ·731 | 1·100 | 1·505 | 1326·9 | 301 | 0 11 | 200 | 0 7¼ | 100 | 0 3¾ | 995 |
| | ·750 | ·730 | 1·099 | 1·505 | 1322·0 | 300 | 0 11 | 200 | 0 7¼ | 100 | 0 3¾ | 992 |
| | ·740 | ·720 | 1·085 | 1·507 | 1269·7 | 289 | 0 10½ | 193 | 0 7 | 96 | 0 3½ | 952 |
| | ·730 | ·710 | 1·071 | 1·509 | 1218·7 | 279 | 0 10¼ | 186 | 0 6¾ | 93 | 0 3½ | 914 |
| 12 | ·729 | ·709 | 1·070 | 1·509 | 1214·2 | 278 | 0 10¼ | 185 | 0 6¾ | 93 | 0 3½ | 911 |
| | ·720 | ·700 | 1·058 | 1·511 | 1170·2 | 269 | 0 9¾ | 180 | 0 6½ | 90 | 0 3¼ | 878 |
| 13 | ·710 | ·690 | 1·045 | 1·514 | 1123·1 | 260 | 0 9½ | 173 | 0 6¼ | 87 | 0 3¼ | 842 |
| | ·700 | ·680 | 1·032 | 1·518 | 1077·2 | 252 | 0 9¼ | 168 | 0 6¼ | 84 | 0 3 | 808 |
| 14 | ·693 | ·673 | 1·024 | 1·521 | 1047·0 | 246 | 0 9 | 164 | 0 6 | 82 | 0 3 | 785 |
| | ·690 | ·670 | 1·020 | 1·523 | 1033·6 | 244 | 0 9 | 162 | 0 6 | 81 | 0 3 | 775 |
| | ·680 | ·660 | 1·009 | 1·529 | 992·1 | 236 | 0 8¾ | 158 | 0 5¾ | 79 | 0 3 | 744 |
| 15 | ·677 | ·657 | 1·006 | 1·531 | 980·2 | 235 | 0 8½ | 156 | 0 5¾ | 78 | 0 2¾ | 735 |
| | ·670 | ·650 | ·999 | 1·537 | 952·8 | 230 | 0 8½ | 154 | 0 5½ | 77 | 0 2¾ | 715 |
| 16 | ·662 | ·642 | ·992 | 1·545 | 923·0 | 226 | 0 8¼ | 151 | 0 5½ | 75 | 0 2¾ | 692 |
| | ·660 | ·640 | ·990 | 1·547 | 915·4 | 225 | 0 8¼ | 150 | 0 5½ | 75 | 0 2¾ | 687 |
| | ·650 | ·630 | ·982 | 1·559 | 879·8 | 220 | 0 8 | 147 | 0 5¼ | 73 | 0 2¾ | 660 |
| 17 | ·649 | ·629 | ·981 | 1·560 | 876·1 | 220 | 0 8 | 146 | 0 5¼ | 73 | 0 2¾ | 657 |
| | ·640 | ·620 | ·977 | 1·575 | 847·8 | 217 | 0 8 | 145 | 0 5¼ | 72 | 0 2¾ | 636 |
| 18 | ·637 | ·617 | ·975 | 1·581 | 837·9 | 216 | 0 8 | 144 | 0 5¼ | 72 | 0 2¾ | 628 |
| | ·630 | ·610 | ·974 | 1·596 | 818·1 | 214 | 0 7¾ | 143 | 0 5¼ | 71 | 0 2½ | 614 |
| 19 | ·626 | ·606 | ·973 | 1·606 | 806·6 | 213 | 0 7¾ | 142 | 0 5¼ | 71 | 0 2½ | 605 |
| | ·620 | ·600 | ·974 | 1·623 | 791·5 | 212 | 0 7¾ | 141 | 0 5¼ | 71 | 0 2½ | 594 |

| Number of Gauge | Diameter of Bore. | Bullet for Proof. | | | | Charge of powder for | | | | | | Service Charge. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Diameter. | Length. | Ratio of Length to Diameter. | Weight. | First Proof. | | | Second Proof | | | Powder. | | | Ball. |
| | inches. | inches. | inches. | | grains. | grs. | oz. | drs. | grs. | oz. | drs. | grs. | oz. | drs. | grains |
| 20 | ·615 | ·595 | ·975 | 1·638 | 779·2 | 211 | 0 | 7¾ | 141 | 0 | 5¼ | 70 | 0 | 2½ | 584 |
| | ·610 | ·590 | ·978 | 1·657 | 768·5 | 211 | 0 | 7¾ | 141 | 0 | 5¼ | 70 | 0 | 2½ | 576 |
| 21 | ·605 | ·585 | ·980 | 1·676 | 757·1 | 210 | 0 | 7¾ | 140 | 0 | 5 | 70 | 0 | 2½ | 568 |
| | ·600 | ·580 | ·985 | 1·698 | 748·0 | 209 | 0 | 7¾ | 140 | 0 | 5 | 70 | 0 | 2½ | 561 |
| 22 | ·596 | ·576 | ·988 | 1·715 | 739·9 | 209 | 0 | 7¾ | 139 | 0 | 5 | 70 | 0 | 2½ | 555 |
| | ·590 | ·570 | ·995 | 1·746 | 729·7 | 208 | 0 | 7½ | 139 | 0 | 5 | 69 | 0 | 2½ | 547 |
| 23 | ·587 | ·567 | ·999 | 1·762 | 725·0 | 207 | 0 | 7½ | 138 | 0 | 5 | 69 | 0 | 2½ | 544 |
| | ·580 | ·560 | 1·012 | 1·808 | 716·4 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 537 |
| 24 | ·579 | ·559 | 1·015 | 1·816 | 716·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 537 |
| Regulation bore. | ·577 | ·557 | 1·021 | 1·833 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 25 | ·571 | ·551 | 1·043 | 1·893 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| | ·570 | ·550 | 1·047 | 1·904 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 26 | ·563 | ·543 | 1·074 | 1·978 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| | ·560 | ·540 | 1·086 | 2·012 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 27 | ·556 | ·536 | 1·103 | 2·057 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 28 | ·550 | ·530 | 1·128 | 2·128 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 29 | ·543 | ·523 | 1·158 | 2·214 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| | ·540 | ·520 | 1·171 | 2·253 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 30 | ·537 | ·527 | 1·185 | 2·292 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 31 | ·531 | ·511 | 1·213 | 2·374 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| | ·530 | ·510 | 1·218 | 2·388 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 32 | ·526 | ·506 | 1·237 | 2·445 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 33 | ·520 | ·500 | 1·267 | 2·534 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 34 | ·515 | ·495 | 1·293 | 2·612 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 35 | ·510 | ·490 | 1·319 | 2·692 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 36 | ·506 | ·486 | 1·341 | 2·759 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 37 | ·501 | ·481 | 1·369 | 2·846 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| | ·500 | ·480 | 1·375 | 2·864 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 38 | ·497 | ·477 | 1·392 | 2·918 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 39 | ·492 | ·472 | 1·422 | 3·012 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| | ·490 | ·470 | 1·434 | 3·051 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 40 | ·488 | ·468 | 1·446 | 3·090 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 41 | ·484 | ·464 | 1·471 | 3·171 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 42 | ·480 | ·460 | 1·497 | 3·254 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 43 | ·476 | ·456 | 1·523 | 3·341 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 44 | ·473 | ·453 | 1·544 | 3·407 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| | ·470 | ·450 | 1·564 | 3·476 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 45 | ·469 | ·449 | 1·571 | 3·499 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 46 | ·466 | ·446 | 1·592 | 3·570 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 47 | ·463 | ·443 | 1·614 | 3·643 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| | ·460 | ·440 | 1·636 | 3·718 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 48 | ·459 | ·439 | 1·644 | 3·744 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 49 | ·456 | ·436 | 1·666 | 3·822 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 50 | ·453 | ·433 | 1·689 | 3·902 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |

| Number of Gauge. | Diameter of Bore. | Bullet for Proof. | | | | Charge of powder for | | | | | | Service Charge. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Diameter. | Length. | Ratio of Length to Diameter. | Weight. | First Proof. | | | Second Proof | | | Powder. | | | Ball. |
| | inches. | inches. | inches. | | grains. | grs. | oz. | drs. | grs. | oz. | drs. | grs. | oz. | drs. | grains |
| Small Bore | ·451 | ·431 | 1·705 | 3·956 | 715·0 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 51·05 | ·450 | ·430 | 1·711 | 3·978 | 714·1 | 205 | 0 | 7½ | 137 | 0 | 5 | 68 | 0 | 2½ | 536 |
| 54·61 | ·440 | ·420 | 1·757 | 4·183 | 699·6 | 203 | 0 | 7½ | 135 | 0 | 5 | 68 | 0 | 2½ | 525 |
| 56·50 | ·430 | ·410 | 1·781 | 4·344 | 675·8 | 198 | 0 | 7¼ | 132 | 0 | 4¾ | 66 | 0 | 2½ | 507 |
| 62·78 | ·420 | ·400 | 1·786 | 4·465 | 645·1 | 191 | 0 | 7 | 127 | 0 | 4¾ | 64 | 0 | 2¼ | 484 |
| 67·49 | ·410 | ·390 | 1·781 | 4·567 | 611·5 | 183 | 0 | 6¾ | 122 | 0 | 4½ | 61 | 0 | 2¼ | 459 |
| 72·68 | ·400 | ·380 | 1·769 | 4·654 | 576·6 | 174 | 0 | 6½ | 116 | 0 | 4¼ | 58 | 0 | 2 | 432 |
| 78·41 | ·390 | ·370 | 1·749 | 4·728 | 540·5 | 165 | 0 | 6 | 110 | 0 | 4 | 55 | 0 | 2 | 405 |
| 84·77 | ·380 | ·360 | 1·724 | 4·790 | 504·4 | 155 | 0 | 5¾ | 103 | 0 | 3¾ | 52 | 0 | 2 | 378 |
| 91·83 | ·370 | ·350 | 1·695 | 4·843 | 468·7 | 145 | 0 | 5½ | 97 | 0 | 3½ | 48 | 0 | 1¾ | 352 |
| 99·70 | ·360 | ·340 | 1·668 | 4·890 | 434·0 | 136 | 0 | 5 | 91 | 0 | 3¼ | 45 | 0 | 1¾ | 325 |
| 108·49 | ·350 | ·330 | 1·627 | 4·930 | 400·0 | 126 | 0 | 4½ | 84 | 0 | 3 | 42 | 0 | 1½ | 300 |
| 118·35 | ·340 | ·320 | 1·587 | 4·960 | 366·8 | 117 | 0 | 4¼ | 78 | 0 | 2¾ | 39 | 0 | 1½ | 275 |
| 129·43 | ·330 | ·310 | 1·543 | 4·978 | 334·7 | 108 | 0 | 4 | 72 | 0 | 2½ | 36 | 0 | 1¼ | 251 |
| 141·95 | ·320 | ·300 | 1·497 | 4·990 | 304·1 | 99 | 0 | 3½ | 66 | 0 | 2½ | 33 | 0 | 1¼ | 228 |
| 156·14 | ·310 | ·290 | 1·449 | 4·997 | 275·1 | 90 | 0 | 3½ | 60 | 0 | 2¼ | 30 | 0 | 1 | 206 |
| 172·28 | ·300 | ·280 | 1·400 | 5·000 | 247·8 | 82 | 0 | 3 | 55 | 0 | 2 | 27 | 0 | 1 | 186 |

Thus far the Act applies to gun barrels of all descriptions generally, and in its table of proof charges to rifles in particular, and as far as the latter are concerned, it remains in the same state up to the present day. But in reference to shot guns on the introduction of the choke-bore in 1875, the London Gunmaker's Company and the Birmingham Guardians, pursuant to sect. 117 of the Gun Barrel Proof Act, made the following new regulations which have since that time been enforced:

## PART I.—AS TO CHOKE-BORED BARRELS.

### Definitions.

1. In the construction of these presents, the following words and expressions have the following meanings, to wit, "Choke-bored barrels" means barrels whereof the diameter of the bore at the muzzle is less than the diameter of the bore at some point behind the muzzle, other than the chamber or recess which contains the cartridge. "The charge of shot" means the aggregate quantity

of shot to be used for the definitive proof of one choke-bored barrel.

### Classification.

2. To the "classification of small arms," contained in Schedule B to the said Act, shall be added a sixth class, comprising small arms having choke-bored barrels.

3. The "third class" and the "fourth class" respectively, mentioned in the said Schedule B., shall henceforth comprise the several and respective classes or description of such arms therein mentioned, except such small arms as shall be constructed with one or more choke-bored barrels.

4. Any small arm having one or more of its barrels choke-bored, and having any other barrel or barrels, shall, in respect of its choke-bored barrel or barrels, be deemed to belong to the sixth class, and, in respect of its other barrel or barrels, to its proper class, under said Schedule B.

### Rule of Proof.

5. For the definitive proof of choke-bored barrels, shot shall be used instead of bullets. The shot used shall be of lead, and of the size and description known in the gun trade as soft shot—size Number 6. The charge of shot shall be, in the aggregate, of the weight prescribed as the weight of the bullet for proof, by the scale set forth in Schedule B., called "Scale for proof of small arms of every description except rifled small arms," taking the diameter of the bore of the barrel at its widest part, exclusive of the chamber or recess containing the cartridge.

6. The wads used shall be placed, one over the powder, and the other over the charge of shot.

7. Barrels for arms of the sixth class shall be proved provisionally and definitively, and nothing in these presents contained shall alter or affect, or be deemed to alter or affect, the mode of provisional proof.

### Conditions Precedent to Proof.

8. The conditions precedent to proof, as to barrels for arms of the sixth class, shall be the same as are stated in Schedule B to the said Act, with reference to barrels for arms of the second and fourth classes, with such addition thereto as hereinafter stated.

9. If any barrel, not being a choke-bored barrel, after being definitely proved and duly marked as so proved, shall be converted

into a choke-bored barrel, such barrel, if entitled under section 114 of the said Act, to be deemed a barrel proved provisionally, shall be deemed to have been proved provisionally within the meaning of section 7 of the Rule of proof set forth in these presents, but shall be liable and shall be subjected to further definitive proof according to its class, and in accordance with the same section.

10. If the converted barrel stands proof, the person or persons respectively entitled under the said Act, to impress marks of proof on the barrel, shall impress on the barrel a new definitive proof mark, denoting the definitive proof of a choke-bored barrel.

11. If any choke-bored barrel, after being proved and marked as proved provisionally, and whether or not it has been proved and marked as proved definitively, shall be converted into a barrel that is not choke-bored, such barrel, if entitled under section 114 of the said Act, to be deemed a barrel proved provisionally, shall be deemed to have been proved provisionally, within the meaning of section 7 of the Rule of proof set forth in these presents; but such barrel shall be liable, and shall be subjected to definitive proof, or, as the case may be, to further definitive proof, such proof to be according to the class to which the barrel belongs.

12. If such converted barrel as last mentioned stands proof, the person or persons respectively entitled under the said Act to impress marks of proof on the barrel shall impress on the barrel a fresh definitive proof mark, denoting the definitive proof of a barrel not being a choke-bored barrel.

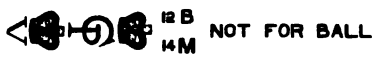
13. All choke-bored barrels sent for proof to the proof house, or any branch proof house, of either of the said two companies, shall be accompanied by a statement in writing, signed by or on behalf of the owner or owners of such barrels, that they are choke-bored barrels, which statement shall be delivered at the proof house, or branch proof house, along with the barrels to which it relates, and unless such statement be so sent and delivered, no liability shall be incurred to the owner or owners of any such barrels, by proving the same as if they were not choke-bored.

## PART II.—AS TO MARKS OF PROOF.

14. The marks denoting definitive proof of choke-bored barrels shall be the proper letter or figure or figures, denoting the gauge size of the barrel at its widest part, exclusive of the chamber or recess containing the cartridge, followed immediately, except in the case hereinafter excepted, by the letter B, and the proper letter or

figure or figures denoting the gauge size of the barrel at its muzzle, followed immediately by the letter M, which letters or figures denoting the gauge sizes respectively shall be struck at the definitive proof; and the proof and view marks now used by the said two companies respectively, as described and delineated in Schedule B. aforesaid, with the addition of the words "Not for ball," which words shall be struck on the barrel on that side of the letters B and M respectively which is nearest to the muzzle. (videlicit):

As to the Gunmakers' Company—




As to the Guardians of the Birmingham Proof House—


The excepted case hereinbefore referred to is that of barrels, the bore of which is enlarged immediately behind the muzzle, but of which, except such enlargement, and also except the chamber or recess containing the cartridge, the bore is not in any part of it larger than at the muzzle.

As to every such barrel, the word "Choke" shall be substituted for the words "Not for Ball" in the proof mark aforesaid, but in all other respects the marks denoting definitive proof of choke-bored barrels of every description shall be identical.

15. The marks denoting definitive proof of barrels not being choke-bored barrels, shall be the proper letter or figure or figures denoting the gauge size of the barrel, which letter or figure or figures shall be struck at the definitive proof; and the proof and view marks, now used by the said two companies respectively, as described and delineated in Schedule B to the said Act.

16. When any barrel of any small arm, which barrel has been proved definitively, or which has been proved in the state for definitive proof, but according to the scale for provisional proof, is brought to the proof house, or any branch proof house of either of the said two companies, to be proved again, definitively, or according to the scale for provisional proof, if such barrel upon being so proved again does not stand proof, the person or persons

respectively who, under the said Act, is or are entitled to impress marks of proof on such barrel, shall efface all the existing marks or definitive proof therefrom.

It is clear from sect. 111 that no one has a right to enlarge the bore of a barrel beyond the diameter of the next gauge, that is to say, in the case of a 13-bore (·710in.) it must not be enlarged to a 12-bore (·729in.). Unfortunately the size of the chambers is not stamped, so that there is nothing to prevent them from being enlarged to any extent, which is a most dangerous but common practice, owing to the variations in the sizes of cartridge cases by different makers, which is to the extent of about ·010in. During the months of September and October, 1882, a correspondence on this subject of reboring barrels or bushing chambers to meet the change in the diameters of brass cartridge cases has been going on in the *Field*, which has led to the following notice being given :

WHEREAS it has been brought to the notice of the Gunmakers' Company, London, that the Barrels of Sporting Guns, already proved to a certain scale of proof, are often bored out to suit other descriptions of cartridge, or the chambers enlarged for bushing, by which the barrels are weakened and the existing proof rendered incorrect. Notice is hereby given, that under the Gun Barrel Proof Act such weakening of the barrel is illegal and dangerous to the public safety, and this company WILL TAKE LEGAL PROCEEDINGS in all cases of such weakening of barrels. And the scale of proof being thereby altered, such barrels will require to be again proved, according to the size of the bore of the barrel as altered. By order,

JOHN RUTTERFORD, Clerk.

with a request from the Proof-master to have the attention of the readers of the *Field* called to it, which request, of course, was complied with, the following editorial remarks being appended by myself:

Unfortunately, the Act, as it now stands will not, in our opinion, enable the company to enforce a penalty for enlarging the *chamber*

without re-proof. No record is made by any proof mark of the size of the chamber when proof is taken, and therefore it cannot be shown that it has subsequently been enlarged. The gauge at the so-called "breech" is taken at about 3in. from the real breech, that is to say, at that distance from the base of the chamber; and there is no other stamp indicating the diameter of that end of the barrel. Thus in the stamp of a choked barrel, the B 12 means the diameter at the distance indicated above, M 14 meaning that of the muzzle. Now, supposing bushing to be carried out, as is now done by Mr. Jones, Messrs. Bland, and others, according to the plan which we have considered to be safe and legal—the gauge at B remains unaltered, and no penalty can, as we think, be legally enforced. But we should hail an alteration in the law which would prevent all tampering with the chamber after proof, even if it also prevented bushing; which, after all, is only a makeshift likely to be adopted by those who cannot afford to pay the difference between its cost and that of new barrels, for an experiment—as, after all that has yet been done, it must still be considered. No one who can spare the few pounds which are here involved would hesitate in preferring a new pair of barrels, since he would then have his choice of paper and brass for his cartridge cases; and this specially so if a really good new pair can be obtained (for the price charged in Birmingham by Mr. Ford and others, viz., 6 guineas. When, however, as was the case with our friend who originally consulted us, a London gunmaker asks 20 guineas for a new pair, we are not surprised that some hesitation should be felt, and that a clever amateur should save this heavy tax on his purse by doing the work himself, or by resorting to so efficient a gunmaker as Mr. Jones.

We would, therefore, urge on the Gunmakers' Company of London, as well as on the Birmingham Guardians, that they at once pass a new regulation, pursuant to sect. 117 of the Gun Barrel Proof Act, which will really enable them to enforce the notice which we publish in our front page. Without this, it is a mere *brutem fulmen*, and will practically have no effect—as far as the chambers are concerned. It will, however, compel Mr. Ford to reprove the barrels he rebores, and this is all that we have contended for. We have not the slightest desire to prevent him or any other barrel maker from making any alteration he pleases in gun barrels, so long as he does not endanger the lives or limbs of his employers. To prevent this, an Act has been passed placing great power in the hands of the London and Birmingham Proof-

houses, by which, if a loophole exists in their present regulations, it may at once be amended; and, now that their attention is drawn to this defect, we have not the slightest doubt that they will carry out the object for which they exist.

In this state the matter is left at the time when these additional pages are in the press.

I cannot resist the desire to recapitulate here the suggestions which I have made in the preceding pages for the greater safety of those using shot guns. First, that the barrels be so stamped that they cannot be afterwards reduced, which is easily done in the definitive proof by affixing figures showing their weight; secondly, that the chambers be gauged and stamped accordingly; and thirdly, that the weight of the actions be also stamped on them so as to prevent a subsequent reduction. If these precautions are taken by the two companies who have charge of the matter, many of the accidents which we now hear of, would, I think, be avoided. The loads used for proof are ample in my opinion, if the guns when definitively proved are not afterwards tampered with, but at present I fear that many cheap guns are "sweated" considerably, and that in the more expensive ones the desire to produce light guns leads to the same result. The two companies must, I think, pass a new regulation to prevent the enlargement of the breech to suit the new brass cases, and when they are doing this they may readily complete their task.

The following are the Belgian proof marks, which, however, as recited in the Act, have no force in this country.

Belgian Proof Marks.

## Scale for Proof of Small Arms of every Description except Rifled Small Arms.

| Number of Gauge. | Diameter of bore by Calculation. | Bullets for Proof. Diameter. | Bullets for Proof. Weight. | Charges of Powder for Proof. First Class. Definitive Proof. grs. | ozs. | drs. | Second Class. Provisional Proof. grs. | ozs. | drs. | Second Class. Definitive Proof. grs. | ozs. | drs. | Third Class. Provisional Proof. grs. | ozs. | drs. | Third Class. Definitive Proof. grs. | ozs. | drs. | Fourth Class. Provisional Proof. grs. | ozs. | drs. | Fourth Class. Definitive Proof. grs. | ozs. | drs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | inches. | inches. | grains. | grs. | ozs. | drs. | grs. | ozs. | drs. | grs. | ozs. | drs. | grs. | ozs. | drs. | grs. | ozs. | drs. | grs. | ozs. | drs. | grs. | ozs. | drs. |
| A | 2·000 | 1·980 | 11682 | — | — | — | — | — | — | — | — | — | 8214 | 18 | 12¾ | 5841 | 13 | 5¼ | 8214 | 18 | 12¾ | 5841 | 13 | 5¼ |
| B | 1·938 | 1·918 | 10618 | — | — | — | — | — | — | — | — | — | 7466 | 17 | 1 | 5309 | 12 | 2¾ | 7466 | 17 | 1 | 5309 | 12 | 2¾ |
| C | 1·875 | 1·855 | 9606 | — | — | — | — | — | — | — | — | — | 6754 | 15 | 7 | 4803 | 10 | 15¾ | 6754 | 15 | 7 | 4803 | 10 | 15¾ |
| D | 1·818 | 1·793 | 8675 | — | — | — | — | — | — | — | — | — | 6100 | 13 | 15 | 4338 | 9 | 14¾ | 6100 | 13 | 15 | 4338 | 9 | 14¾ |
| E | 1·750 | 1·730 | 7792 | — | — | — | — | — | — | — | — | — | 5479 | 12 | 8⅓ | 3896 | 8 | 14½ | 5479 | 12 | 8⅓ | 3896 | 8 | 14½ |
| F | 1·688 | 1·668 | 6984 | — | — | — | — | — | — | — | — | — | 4911 | 11 | 8½ | 3492 | 7 | 15¾ | 4911 | 11 | 8½ | 3492 | 7 | 15¾ |
| 1 | 1·669 | 1·649 | 6752 | — | — | — | — | — | — | — | — | — | 4748 | 10 | 13¾ | 3376 | 7 | 11½ | 4748 | 10 | 13¾ | 3376 | 7 | 11½ |
| H | 1·625 | 1·605 | 6222 | — | — | — | — | — | — | — | — | — | 4375 | 10 | 0 | 3111 | 7 | 1¾ | 4375 | 10 | 0 | 3111 | 7 | 1¾ |
| J | 1·563 | 1·543 | 5529 | — | — | — | — | — | — | — | — | — | 3887 | 8 | 14¼ | 2764 | 6 | 5 | 3887 | 8 | 14¼ | 2764 | 6 | 5 |
| K | 1·500 | 1·480 | 4879 | — | — | — | — | — | — | — | — | — | 3431 | 7 | 13½ | 2440 | 5 | 9¼ | 3431 | 7 | 13½ | 2440 | 5 | 9¼ |
| L | 1·438 | 1·418 | 4291 | — | — | — | — | — | — | — | — | — | 3017 | 6 | 14¼ | 2146 | 4 | 14½ | 3017 | 6 | 14¼ | 2146 | 4 | 14½ |
| M | 1·375 | 1·355 | 3744 | — | — | — | — | — | — | — | — | — | 2633 | 6 | 0¼ | 1872 | 4 | 4½ | 2633 | 6 | 0¼ | 1872 | 4 | 4½ |
| 2 | 1·325 | 1·305 | 3342 | — | — | — | — | — | — | — | — | — | 2350 | 5 | 6 | 1671 | 3 | 13 | 2350 | 5 | 6 | 1671 | 3 | 13 |
| O | 1·313 | 1·293 | 3253 | — | — | — | — | — | — | — | — | — | 2287 | 5 | 3¾ | 1627 | 3 | 11½ | 2287 | 5 | 3¾ | 1627 | 3 | 11½ |
| P | 1·250 | 1·230 | 2800 | — | — | — | — | — | — | — | — | — | 1969 | 4 | 8 | 1400 | 3 | 3¼ | 1969 | 4 | 8 | 1400 | 3 | 3¼ |
| 3 | 1·157 | 1·137 | 2211 | 1555 | 3 | 8¾ | 1555 | 3 | 8¾ | 778 | 1 | 12⅓ | — | — | — | 1244 | 2 | 13⅓ | 1244 | 2 | 13⅓ | 778 | 1 | 12⅓ |
| 4 | 1·052 | 1·032 | 1649 | 1159 | 2 | 10½ | 1159 | 2 | 10½ | 580 | 1 | 5¼ | — | — | — | 928 | 2 | 2 | 928 | 2 | 2 | 580 | 1 | 5¼ |
| 5 | ·976 | ·956 | 1315 | 925 | 2 | 1¾ | 925 | 2 | 1¾ | 463 | 1 | 1 | — | — | — | 740 | 1 | 11 | 740 | 1 | 11 | 463 | 1 | 1 |
| 6 | ·919 | ·899 | 1090 | 766 | 1 | 12 | 766 | 1 | 12 | 383 | — | 14 | — | — | — | 612 | 1 | 6⅓ | 612 | 1 | 6⅓ | 383 | — | 14 |
| 7 | ·873 | ·853 | 931 | 656 | 1 | 8 | 656 | 1 | 8 | 328 | — | 12 | — | — | — | 525 | 1 | 3¼ | 525 | 1 | 3¼ | 328 | — | 12 |
| 8 | ·835 | ·815 | 812 | 602 | 1 | 6 | 602 | 1 | 6 | 301 | — | 11 | — | — | — | 481 | 1 | 1½ | 481 | 1 | 1½ | 301 | — | 11 |
| 9 | ·803 | ·783 | 720 | 492 | 1 | 2 | 492 | 1 | 2 | 246 | — | 9 | — | — | — | 394 | — | 14⅓ | 394 | — | 14⅓ | 246 | — | 9 |
| 10 | ·775 | ·755 | 646 | 465 | 1 | 1 | 465 | 1 | 1 | 232 | — | 8½ | — | — | — | 372 | — | 13½ | 372 | — | 13½ | 232 | — | 8½ |
| 11 | ·751 | ·731 | 586 | 437 | — | 16 | 437 | — | 16 | 219 | — | 8 | — | — | — | 350 | — | 12¾ | 350 | — | 12¾ | 219 | — | 8 |
| 12 | ·729 | ·709 | 535 | 437 | — | 16 | 437 | — | 16 | 219 | — | 8 | — | — | — | 350 | — | 12¾ | 350 | — | 12¾ | 219 | — | 8 |
| 13 | ·710 | ·690 | 493 | 410 | — | 15 | 410 | — | 15 | 205 | — | 7½ | — | — | — | 328 | — | 12 | 328 | — | 12 | 205 | — | 7½ |
| 14 | ·693 | ·673 | 457 | 383 | — | 14 | 383 | — | 14 | 191 | — | 7 | — | — | — | 306 | — | 11¼ | 306 | — | 11¼ | 191 | — | 7 |
| 15 | ·677 | ·657 | 425 | 383 | — | 14 | 383 | — | 14 | 191 | — | 7 | — | — | — | 306 | — | 11¼ | 306 | — | 11¼ | 191 | — | 7 |
| 16 | ·662 | ·642 | 399 | 369 | — | 13⅓ | 369 | — | 13⅓ | 185 | — | 6¾ | — | — | — | 295 | — | 10¾ | 295 | — | 10¾ | 185 | — | 6¾ |
| 17 | ·649 | ·629 | 374 | 369 | — | 13⅓ | 369 | — | 13⅓ | 185 | — | 6¾ | — | — | — | 295 | — | 10¾ | 295 | — | 10¾ | 185 | — | 6¾ |
| 18 | ·637 | ·617 | 352 | 342 | — | 12⅓ | 342 | — | 12⅓ | 171 | — | 6½ | — | — | — | 273 | — | 10 | 273 | — | 10 | 171 | — | 6½ |
| 19 | ·626 | ·606 | 334 | 301 | — | 11 | 301 | — | 11 | 150 | — | 5½ | — | — | — | 241 | — | 8¾ | 241 | — | 8¾ | 150 | — | 5½ |
| 20 | ·615 | ·595 | 316 | 273 | — | 10 | 273 | — | 10 | 137 | — | 5 | — | — | — | 219 | — | 8 | 219 | — | 8 | 137 | — | 5 |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | ·605 | ·585 | 300 | 278 | — | 10 | 278 | — | 10 | 137 | — | 5 | — | — | — | 219 | — | 8 | 219 | — | 8 | 137 | — | 5 |
| 22 | ·596 | ·576 | 287 | 246 | — | 9 | 246 | — | 9 | 123 | — | 4½ | — | — | — | 197 | — | 7¼ | 197 | — | 7¼ | 123 | — | 4½ |
| 23 | ·587 | ·567 | 274 | 246 | — | 9 | 246 | — | 9 | 123 | — | 4½ | — | — | — | 197 | — | 7¼ | 197 | — | 7¼ | 123 | — | 4½ |
| 24 | ·579 | ·559 | 262 | 232 | — | 8¼ | 232 | — | 8¼ | 116 | — | 4⅛ | — | — | — | 186 | — | 6⅝ | 186 | — | 6⅝ | 116 | — | 4⅛ |
| 25 | ·571 | ·551 | 251 | 232 | — | 8¼ | 232 | — | 8¼ | 116 | — | 4⅛ | — | — | — | 186 | — | 6⅝ | 186 | — | 6⅝ | 116 | — | 4⅛ |
| 26 | ·563 | ·543 | 242 | 232 | — | 8¼ | 232 | — | 8¼ | 116 | — | 4⅛ | — | — | — | 186 | — | 6⅝ | 186 | — | 6⅝ | 116 | — | 4⅛ |
| 27 | ·556 | ·536 | 231 | 232 | — | 8¼ | 232 | — | 8¼ | 116 | — | 4⅛ | — | — | — | 186 | — | 6⅝ | 186 | — | 6⅝ | 116 | — | 4⅛ |
| 28 | ·550 | ·530 | 223 | 232 | — | 8¼ | 232 | — | 8¼ | 116 | — | 4⅛ | — | — | — | 186 | — | 6⅝ | 186 | — | 6⅝ | 116 | — | 4⅛ |
| 29 | ·543 | ·523 | 214 | 205 | — | 7½ | 205 | — | 7½ | 102 | — | 3¾ | — | — | — | 164 | — | 6 | 164 | — | 6 | 102 | — | 3¾ |
| 30 | ·537 | ·517 | 207 | 205 | — | 7½ | 205 | — | 7½ | 102 | — | 3¾ | — | — | — | 164 | — | 6 | 164 | — | 6 | 102 | — | 3¾ |
| 31 | ·531 | ·511 | — | 205 | — | 7½ | 205 | — | 7½ | 102 | — | 3¾ | — | — | — | 164 | — | 6 | 164 | — | 6 | 102 | — | 3¾ |
| 32 | ·526 | ·506 | 194 | 205 | — | 7½ | 205 | — | 7½ | 102 | — | 3¾ | — | — | — | 164 | — | 6 | 164 | — | 6 | 102 | — | 3¾ |
| 33 | ·520 | ·500 | — | 191 | — | 7 | 191 | — | 7 | 96 | — | 3½ | — | — | — | 153 | — | 5⅝ | 153 | — | 5⅝ | 96 | — | 3½ |
| 34 | ·515 | ·495 | 182 | 191 | — | 7 | 191 | — | 7 | 96 | — | 3½ | — | — | — | 153 | — | 5⅝ | 153 | — | 5⅝ | 96 | — | 3½ |
| 35 | ·510 | ·490 | — | 191 | — | 7 | 191 | — | 7 | 96 | — | 3½ | — | — | — | 153 | — | 5⅝ | 153 | — | 5⅝ | 96 | — | 3½ |
| 36 | ·506 | ·486 | 172 | 191 | — | 7 | 191 | — | 7 | 96 | — | 3½ | — | — | — | 153 | — | 5⅝ | 153 | — | 5⅝ | 96 | — | 3½ |
| 37 | ·501 | ·481 | — | 191 | — | 7 | 191 | — | 7 | 96 | — | 3½ | — | — | — | 153 | — | 5⅝ | 153 | — | 5⅝ | 96 | — | 3½ |
| 38 | ·497 | ·477 | 162 | 178 | — | 6½ | 178 | — | 6½ | 89 | — | 3¼ | — | — | — | 142 | — | 5¼ | 142 | — | 5¼ | 89 | — | 3¼ |
| 39 | ·492 | ·472 | — | 178 | — | 6½ | 178 | — | 6½ | 89 | — | 3¼ | — | — | — | 142 | — | 5¼ | 142 | — | 5¼ | 89 | — | 3¼ |
| 40 | ·488 | ·468 | 154 | 178 | — | 6½ | 178 | — | 6½ | 89 | — | 3¼ | — | — | — | 142 | — | 5¼ | 142 | — | 5¼ | 89 | — | 3¼ |
| 41 | ·484 | ·464 | — | 164 | — | 6 | 164 | — | 6 | 82 | — | 3 | — | — | — | 131 | — | 4⅞ | 131 | — | 4⅞ | 82 | — | 3 |
| 42 | ·480 | ·460 | 146 | 164 | — | 6 | 164 | — | 6 | 82 | — | 3 | — | — | — | 131 | — | 4⅞ | 131 | — | 4⅞ | 82 | — | 3 |
| 43 | ·476 | ·456 | — | 164 | — | 6 | ·164 | — | 6 | 82 | — | 3 | — | — | — | 131 | — | 4⅞ | 131 | — | 4⅞ | 82 | — | 3 |
| 44 | ·473 | ·453 | 139 | 164 | — | 6 | 164 | — | 6 | 82 | — | 3 | — | — | — | 131 | — | 4⅞ | 131 | — | 4⅞ | 82 | — | 3 |
| 45 | ·469 | ·449 | — | 150 | — | 5½ | 150 | — | 5½ | 75 | — | 2¾ | — | — | — | 120 | — | 4⅜ | 120 | — | 4⅜ | 75 | — | 2¾ |
| 46 | ·466 | ·446 | 133 | 150 | — | 5½ | 150 | — | 5½ | 75 | — | 2¾ | — | — | — | 120 | — | 4⅜ | 120 | — | 4⅜ | 75 | — | 2¾ |
| 47 | ·463 | ·443 | — | 150 | — | 5½ | 150 | — | 5½ | 75 | — | 2¾ | — | — | — | 120 | — | 4⅜ | 120 | — | 4⅜ | 75 | — | 2¾ |
| 48 | ·459 | ·439 | 127 | 150 | — | 5½ | 150 | — | 5½ | 75 | — | 2¾ | — | — | — | 120 | — | 4⅜ | 120 | — | 4⅜ | 75 | — | 2¾ |
| 49 | ·456 | ·436 | — | 150 | — | 5½ | 150 | — | 5½ | 75 | — | 2¾ | — | — | — | 120 | — | 4⅜ | 120 | — | 4⅜ | 75 | — | 2¾ |
| 50 | ·453 | ·433 | 122 | 150 | — | 5½ | 150 | — | 5½ | 75 | — | 2¾ | — | — | — | 120 | — | 4⅜ | 120 | — | 4⅜ | 75 | — | 2¾ |

N.B.—Revolving arms shall be proved according to the scale laid down for definitive proof for the fourth class. A barrel of any description to which the foregoing scales of proof are inapplicable or unsuitable shall be proved with such a bullet as shall be applicable to the dimensions of the bore of such barrel, and with such a charge of gunpowder as shall not be less than twice the service charge, or in case the barrel shall not be capable of holding twice the service charge, with as much powder as the barrel shall be capable of holding.

## SECTION II.

### Trial of the Gun for Efficiency by Shooting at a Target.

A variety of plans for testing the efficiency of shot guns has been tried during the last thirty or forty years, prior to which time most sportsmen were contented to rely on their gunmakers for good work. Col. Hawker, whose book on shooting, published in 1814, was for the first half of the present century the accepted authority on guns, established no standard even of pattern, his test for duck guns being "twenty sheets of thickest brown paper placed in the middle of a sheet of water" and tested at 90 yards. For smaller bores he recommends "a quire of the thickest brown paper by which," he says, "the shooter will know to a certainty both the *strength* and *closeness* with which the shot is driven; and he should remember that the *strongest* and most *regular shooting* gun is the *best,* provided it does not throw the shot so thin as for a bird to escape between them." But he does not inform us what the pattern should be, nor does he state the number of sheets which should be pierced. After the death in 1835 of the celebrated Joe Manton, who was *facile princeps* in the London trade, a keen competition arose among his successors, and the abovementioned pad composed of brown paper was adopted as a test of penetration by several leading gunmakers, and was generally supplied to them by Messrs. Pettitt, stationers, of Frith Street, Soho. When, therefore, I attempted to settle the claims of the Lefaucheux breechloader to compete with the muzzleloader in 1858 by means of a public trial under the auspices of the *Field* newspaper, I accepted that test as the only one then in vogue, and

the defeat of the new gun both for pattern and penetration was the result; which was still further confirmed by another contest in the following year in which there were twenty-nine competitors, that of 1858 being too limited in numbers to form a reliable ground for the settlement of the conflicting systems. As the paper pads had generally been supplied to the trade by Messrs. Pettitt, I obtained them from the same source, and continued their use in the various trials held under my management until that of 1879, when, finding that the paper varied greatly from year to year, and that the effect of shot on pads from the same stock on different days even in the same week differed as much as 10 or 15 per cent., I determined to try a new plan, and with the aid of Mr. Green, of Cheltenham, and Mr. Jones, of Birmingham, effected my object, the result being the production of the machine now known as the *Field force gauge*.

With the Pettitt pads it is true that a rough guess could be made as to the power of a gun, but only a very rough one, and the test is always open to fraud, for a gunmaker in exhibiting it to a customer can readily make the pad record more than it otherwise would do, by pressing it open while held in the two hands in taking it up to the target. Moreover, it only pretends to show the penetration of a limited number of pellets (at first one, afterwards three), while that of the remaining shot hitting the pad, averaging 25 to 30 in cylinders, and 40 to 60 in choke bores, is entirely neglected. It is, of course, possible to count the penetration of every pellet striking the pad, and this I have myself done in many instances for experimental purposes, but the task is so troublesome that it is out of the question. Yet the effect of three pellets on the game shot at is comparatively unimportant, and what is really wanted is a record of the average penetration of the central part of the charge which may be taken as about 10 inches square. It is in this point that, according to my

judgment, the force gauge beats the Pettitt pad, still more than in its uniformity, which latter is, however, a most important one. Guns will no doubt vary in their performances both as to pattern and penetration on different days, being apparently affected by the condition of the air as to dampness and possibly also as to weight, and therefore it is not to be expected that because a gun does supremely well in a particular trial it will always repeat this performance when submitted to the same test. Mr. Griffith, the very scientific manager of the Schultze powder company, has demonstrated by a very clever contrivance, which I shall presently describe, that in different guns this superior velocity of some pellets over others varies very greatly, though by examining the Pettitt pads after shooting at them the fact is patent enough, as in many cases the pellet does not even break a single sheet, and in others one, two, three, or more up to the number at which only three have had that effect. From these varying conditions in the two tests it results that they do not always agree, and that, while increasing the charge of powder will drive, say, 5 per cent. of the pellets in the killing centre of 10-inches square through more sheets than before, the average penetration will not only not be increased, but will absolutely fall off. It was known long before 1879 that there is a limit to the charge of powder which each gun will bear without injury to its performance either in penetration or pattern or both, but, curiously enough, it was not admitted that the test as taken from three pellets was not a test of the average penetration of the central group; nor is this point as yet accepted by all sportsmen and gunmakers, and yet it is a most important one, and easily demonstrable either by the Pettitt pad or the force gauge.

No experiment with which I am acquainted has yet shown the cause of this difference between the force or velocity of the several pellets comprising the charge of small shot; but

one thing is fully demonstrated, viz., that when tested by paper, those pellets doing most work are the least altered from the spherical shape in which they were placed in the gun. But the cause of this variation in deformity is not so easily ascertained. My own belief is that it is probably due to the greater or less initial pressure made on that part of the charge which comes against the cone; and it is borne out by the alleged superiority of coarse powder over very fine in effecting penetration (though this is denied by some of those who have made experiments with a view to settle the question), and also by the result of recent trials with brass cases in which the cone is abolished. As far as my experience goes, No. 6 grain is better than No. 4 for this purpose with most guns; but no doubt when a gun is expressly bored for a particular powder it may be expected to perform better with it than with any other, though even to this rule there have been notable exceptions within my own experience, to some of which I have drawn the attention of the public. Again, there is reason to believe that the paper test favours Schultze powder in point of penetration more than the force gauge, which accords with the fact that its initial pressure on explosion is greater than that of black powder, and presumably its deforming effect on the shot. Its superior effect even on the force gauge is, however, sufficient to establish its claim in this respect; and it, therefore, need not occasion any surprise that Mr. Griffith accepts the machine without mentioning this slight drawback to it, as far as his company are concerned.

Besides the Pettitt pad and the force gauge, thin straw cardboard placed in a rack has been tried in America, notably in the Chicago trial of 1879, and is considered by Mr. W. W. Greener to be the best of the three tests, at all events for private trials; his arguments in its favour being based on the fact that the results are increased *pari passu* with the

increase of powder charge, though he admits "that the atmosphere will to some extent cause the resisting power of the strawboard to vary; but still," he says, "all charges fired on the same day may be compared (and to be strictly correct all guns at any trial should be fired on the same day), so that the slight variation in the cardboard is but a bagatelle." It is quite true, as I have before remarked, that guns will vary in their performances in different states of weather, and therefore ought to be tested together at the same time; but surely that is no reason for the introduction of another uncertain element in their comparison. The sheets of this cardboard are placed in a wooden trough, three-quarters of an inch apart, and it is found that an average gun will penetrate with one pellet from twenty to twenty-five sheets at 40 yards, so that here the same objection with regard to the average penetration comes into force as with the Pettitt pad, and in a still stronger degree if only one pellet is relied on instead of three, as has hitherto been the practice. Mr. Jones has, however, so much improved on the manufacture of the force gauge that even Mr. Greener now admits its merits, and in the recent trials of Kynoch's cartridge cases, to which I shall hereafter refer, has relied solely upon it.

Having thus briefly alluded to the various plans adopted for testing guns as to penetration, I may now allude to that for pattern, which for the last fifty years has been a circular target, 30 inches in diameter, fixed at 40 yards from the gun, which is considered to be best suited for the sportsman's requirements. No one objects to this test between guns of the same gauge; but as between large and small bores, such as 12 and 20-bores, it no doubt is not entirely reliable, inasmuch as the smaller bores will not take so large a charge of shot as the 12-bore, and consequently a greater proportion of it is outside the 30-inch circle, and is not in the calculation. However good may be

the sportsman's aim, there are days, and times in every day, when he is not dead on his bird, and in that case the larger the killing circle the better will be his success; but this result is more apparent with the bad shot than with the good. Still it must not be lost sight of in comparing the three gauges, as I have already remarked in the second chapter.

I may here observe that many gunmakers, instead of counting the pellets striking the target within a prescribed 30in. circle, fire at a larger area of, say, 4ft. square, and then select a circle of 30 inches anywhere within it, each taking the centre which will be most favourable to the gun. This, called the "selected pattern," is all very well so long as they are regulating their guns, because until the barrels are properly put together due justice will not otherwise be done to each. But when the gun is put into the sportsman's hands no such allowance ought to be made; for, if not properly put together, so that the aim of both barrels shall coincide on the same spot, it is useless for his purposes.

The next point to be described is the construction of the several tests to which I have alluded above.

The Pettitt pad is composed of forty thicknesses of brown paper, about ten inches square, pressed and stitched together at the corners. In the early trials the paper used was what is called bagcap, 50lb. to the ream, but in 1866 it was changed to double imperial, 140lb. per ream. At first one pellet only was traced, the number of sheets broken by it being recorded. This was changed to three pellets in 1875, and, in order to make penetration have its due weight as against pattern, the number of sheets penetrated was multiplied by six both in 1866 with one pellet, and in 1875 with three. Thus, supposing the pattern of one gun (A) to be 135 and its penetration 35 sheets, while the pattern of another (B) is 140, with a penetration of 32 sheets, B would win under the old conditions, although only slightly superior in pattern, and yet be beaten in

penetration nearly 10 per cent. Under the new conditions, however, A. would have a figure of merit of 345, against B's 332, and this would be really the relative merits of the two guns, as nearly as may be. In both cases the figure of merit was composed of the recorded pattern added to the penetration.

The 1875 trial was instituted with a view to test the powers of the choke-bore, then just brought before the public by Mr. W. W. Greener. It was clearly proved by it that any desired average pattern might be obtained, and therefore it was afterwards unnecessary to make the average pattern an element in the drawing of the figure of merit. Its defect was then shown to be irregularity of shooting, a wild shot of perhaps sixty or seventy pellets in the 30-inch circle occurring so frequently as to interfere greatly with its utility. As a consequence of this, and with a view to enable gunmakers to show what could be done in the next trial (that of 1878, which was a trial of powder more than of guns), the figure of merit was still founded on the penetration of three pellets, multiplied by six, so as to serve as a comparison with previous records in that respect. In order to test regularity there was deducted from this foundation the difference between the lowest pattern (wild) and the average pattern, and also the recoil above 50lb., and its variation. Thus, the figure was made up as follows:

| | | | |
|---|---|---|---|
| Average penetration × by six ... ... ... ... ... ... | say | | 174 |
| Difference between lowest pattern and average ... | say | 27 | |
| Recoil above 50lb. ... ... ... ... ... ... ... ... | say | 36 | |
| Difference in recoils ... ... ... ... ... ... ... ... | say | 4·50 | |
| | | | 67·50 |
| Figure of merit ... ... | | | 116·50 |

Since that time I have discarded the Pettitt pad for the reasons already given; but it is still used by many gunmakers and private gentlemen, though without the introduction of recoil into the figure of merit, which can only be calculated

with a machine rest. As, however, the regularity of pattern is still an important point, it is well to test the gun in that respect, and in comparing two guns of the same bore I should always advise that the figure of merit should be composed of the penetration less the difference between the lowest pattern and the average, which will in fact test the regularity of pattern and the penetration; for when the pattern desired can always be readily obtained there is no merit in obtaining it. But where there is a difficulty in this, as is the case with 16 and 20-bores, the figure of merit should be made up of pattern plus penetration, and here it is scarcely necessary to make any deduction for irregularity, as since I discovered its cause in 1878 excessively wild shots have become almost unknown, as was demonstrated in the Field Trial of 1879. In any case, it is hardly necessary to introduce the recoil.

The force gauge, which I first introduced to the public as a test of what had been long called "penetration," in place of the Pettitt pad, is a machine which registers automatically the effect produced by the blow given by the central pellets of a charge on a spiral spring. In order to compare it with the pad as nearly as may be, the same area of the 30-inch circle was adopted, that is to say, 10 inches square, the pad being 10½ by 9½ inches, which, for the sake of economy in cutting up the sheets of paper, was the shape adopted. By general consent this is considered to give a correct estimate of the central part of the charge, for it is found that the pellets striking the outside of the 30-inch circle have much less force than those in the centre, if the aim has been true. In a good cylinder barrel there are usually from twenty-five to thirty pellets striking the 10-inch plate, while a full choke varies from fifty to seventy, in the former case being about one-fifth of the whole number on the plate, and in the latter from one-third to one-fourth. The plate (see *a, a* in the frontispiece) is made of 17-gauge steel turned up at the edges, and having a

horizontal platform (*b*) firmly attached to its back and about 3 inches wide. To allow this plate to give way to the blow of the shot, it is suspended by four parallel arms (*c, c*) to a strong frame (*d, d, d*), which I originally made of wood, but which is now a solid piece of cast-iron, as made by Mr. Jones, of 75, Bath-street, Birmingham, who undertook to make the gauge for general use, and has carried out his task to my entire satisfaction. As the platform travels backwards, a small friction roller (*k*) drives the short arm (*f*) of the lever (*f, g*) backwards, the long arm (*g*) travelling in the opposite direction, but in the proportion of 9 to 1 in point of distance, the centre being at *h*. At the end of the long arm is a vulcanite pointer, which travels on a plate of white metal, which is coated with black paint immediately before each shot. As a consequence of this arrangement, when the steel plate is struck, it drives the pointer a certain distance on the plate, removing the black paint, and leaving a white line as shown in the engraving. In the gauge used by me two spiral springs made by Salter arrested this blow, one being weaker than the other, and the two being so fixed that the strong spring did not come into operation until the weaker one had spent its force, but Mr. Jones now effects the same purpose with only one spring. At the top of the glass plate a scale (*l, l*) is fixed, set out on a plan to be presently described.

Of course it is plain enough that this gauge can be used to compare two or more guns fired against one another at any fixed time, the one recording the greatest force in proportion to the number of pellets striking the plate having manifestly the stronger penetration; and if the gauge stopped there it would only have the advantage over the Pettitt pad that it would record the average penetration of the centre pellets varying from 25 to 70, as the case may be, instead of that effected by three pellets out of the respective numbers. But

by adopting the principle of the falling weight, which is known to be invariable in its blow, and applying it to the machine, it can be at any time set so as to render it always the same. It matters not, as has long been admitted, whether the weight falls perpendicularly, or down an inclined plane irrespective of friction, the same blow is given when it reaches the ground, or any body placed on the ground; and, acting on this well-known principle, I attached hammers of various weights (as shown at *p*) to the frame of the machine, exactly one foot above the centre of the steel plate, by means of a light wooden handle weighing only an ounce; and working freely on a central spindle, so that when held up to a horizontal position and let fall it would give a blow to the steel plate of the same force as if it had fallen one foot directly downwards. Here, then, was a certain fixed force, which on the scale is marked by multiplying the weight in ounces by 8. Thus, when a 2oz. hammer was used, the point opposite the end of the white line was set out as 16; when a 4oz. hammer was used, 32; an 8oz., 64; a 12oz., 96, and so on; and, for want of a better name, I described these figures as representing "force ounces." In the machine used by me the hammer heads were of wood, each weighing half an ounce less than the supposed weight, to allow for the handle which was the same for all. Mr. Jones, however, has substituted hammers composed of the metal used for chilled shot, and this is no doubt an improvement in every respect, the wood having the disadvantage that it loses weight by drying. In addition to the above mentioned improvements, Mr. Jones also uses a catch and trigger by which the hammers are always let fall from the same height and in the same manner. When the machine is once constructed on these principles, it is liable to very little variation even by carriage or damp, but the 8oz. hammer should always be used to test it before a trial, and if the

effect is not in accordance with the above, the spring is increased or lowered in force by turning a screw. Lastly, the gauge is attached to the front of the usual plate by a clip, and protected from the splash of the shot on its outside by inclosing it with iron doors, which, however, are not shown in the engraving. In the 1879 trial I placed the steel plate behind the paper on which the pattern was recorded, but Mr. Jones' machine is fixed bodily in front of the ordinary 30-inch target, and the steel 10-inch plate is washed with whitewash in the same way as the large plate.

In order to get at the "force" of a gun, all that is necessary therefore is first to ascertain that the machine is correctly set, and then to fire a series of twenty-five shots at it, a record of each being taken from the scale and also the number of pellets striking the plate. Then after each shot dividing the whole force by the number of pellets, the force per pellet is ascertained. Thus, supposing 50 pellets strike the plate and the scale records 102, by adding two noughts to 102 it is made 10,200, and dividing this by 50 we get 2·04 force ounces as the average force per pellet. To facilitate the calculation, a table was constructed and used at the trial, and this of course is sold with the machine, enabling the shooter to ascertain at once the force of each shot.

After the first outlay for this gauge (7*l.*) no further expense is needed, the black paint and whitewash being the only materials used. When it is remembered that each Pettitt pad costs 6*d.*, and that to get at the true penetration of a gun at least a dozen pads must be used, it will readily appear that to a gunmaker who really tests his work a great saving is effected. There are, however, very few who go to any great expense on brown paper, the majority contenting themselves with the aspect of the plate in point of "splash;" but, though this is some indication of penetration, it is a very poor one. A very few first class makers, whose price will

afford it, are known to spare no pains in this way, and by them no doubt the force gauge will be found very serviceable. Gradually, I am told by Mr. Jones, it is finding its way into their ranges, and in course of time I believe no sportsman will buy a first class gun without having it tested by it.

In order to prove the fact previously theoretically held that the force of the several pellets in a charge varies considerably, Mr. Griffith, manager of the Schultze Powder Company, adapted to the force gauge a little apparatus by which it was clearly demonstrated. His plan was described by himself in the *Field* of June 14th, 1879. He says:

While testing powder for penetration by means of the force gauge, I have several times noticed that an increase in charge of powder was not followed by increase of penetration as marked by the gauge; and at other times a powder known to possess more strength than another sample has not scored so well in penetration as the weaker sample; the same thing has very likely been noticed by others using the force gauge. To investigate the cause of these seemingly contradictory results, I instituted a series of experiments; and, thinking the results may prove interesting, I am sending you results of some of the shooting.

Now, the force marked on the *Field* force gauge is due to the velocity with which the shots strike the plate, as so well explained in the letter from your correspondent "T." in your issue of May 10. But it affects the result very materially whether the flight of pellets strike the plate and communicate to it their momentum at the same instant, or whether they arrive in detachments, and (as the plate held by a spring is ever ready to rebound after the blow) waste much of their momentum in overcoming the rebound of the spring after the blow from the previous detachment. And this, I think, constitutes an important point to be welcomed in the force gauge; for, testing by it, wild shots have no chance, and strong shots which would probably put several pellets right through a forty-five-sheet pad, but leave the remainder sticking in the middle, are nowhere with the gauge in comparison with steadily propelled charges which reach the plate simultaneously.

In the letter from T. of May 10, the velocity of the pellets on striking the plate is calculated at 592 feet per second for the

12-bores. "Experiment" is quoted as making the mean velocity, by personal observation, 600 feet per second. By putting the force gauge in circuit with a Boulengé chronograph, I have taken the exact *mean* velocities of several loads at 40 yards distance; the mean velocities will of course be more than the striking velocity, as the pellets are constantly losing momentum. The velocities recorded also are the mean velocities of the fastest shot only—*i.e.*, the one that touches the plate first and breaks contact. To estimate the velocities of the succeeding shots by chronographs would require extensive appliances not at my command. But it is sufficient for the present purpose to take the mean velocity of the shots that arrive first at the target; and the average speed from a 12-bore, with 3 drs. powder and $1\frac{1}{8}$oz. shot, is about 880 feet per second. With steady shooting the penetration given by the force gauge corresponds with the velocity; but with wild or scattered shooting the penetration falls off considerably from the degree you would expect from the registered velocity of that shot. I append tables of series of shots of various loads, and powders, and methods of loading, giving penetration and velocity produced by same shot at same time. I have taken two of each for correction. To take some of the examples: Nos. 3 and 4 give higher velocity than 1 and 2, as you would expect from using $\frac{1}{2}$dr. more powder, but they do not equal by a long way the penetration of the less charge, because the larger charge scatters too much, or sends the shot up too unevenly from this gun to score well. Compare 5 and 6 with 1 and 2. The finer grain black powder gives stronger shooting than the No. 4, as is evidenced by the much higher velocity; but the penetration does not mark so high, showing the finer is not so suited to the gun. Nos. 7 and 8 give higher in both respects than 5 and 6, but not so much increase in penetration as in velocity. With Schultze's $2\frac{3}{4}$drs. (9 and 10) the shot must have gone up quite together to produce the good penetration, though having only such comparatively poor velocity. The three couples 13 and 14, 15 and 16, 17 and 18, represent three methods of turning over the case—well turned over, slightly, or not at all.

It is a well-known fact that velocity with Schultze is increased by increasing the turning over up to a certain extent, at the expense of getting more scattered shooting. This is borne out entirely by these three examples. The well turned-over gives far better velocity, but not such good penetration as the not turned-over at all; while the slightly turned-over occupy a middle position.

(*Ergo*, to insure steadiness of shooting, don't turn over too much of the case.) The $3\frac{1}{2}$drs. in 17 and 18 give great velocity, and very fair penetration ; but the penetration is almost equalled by the

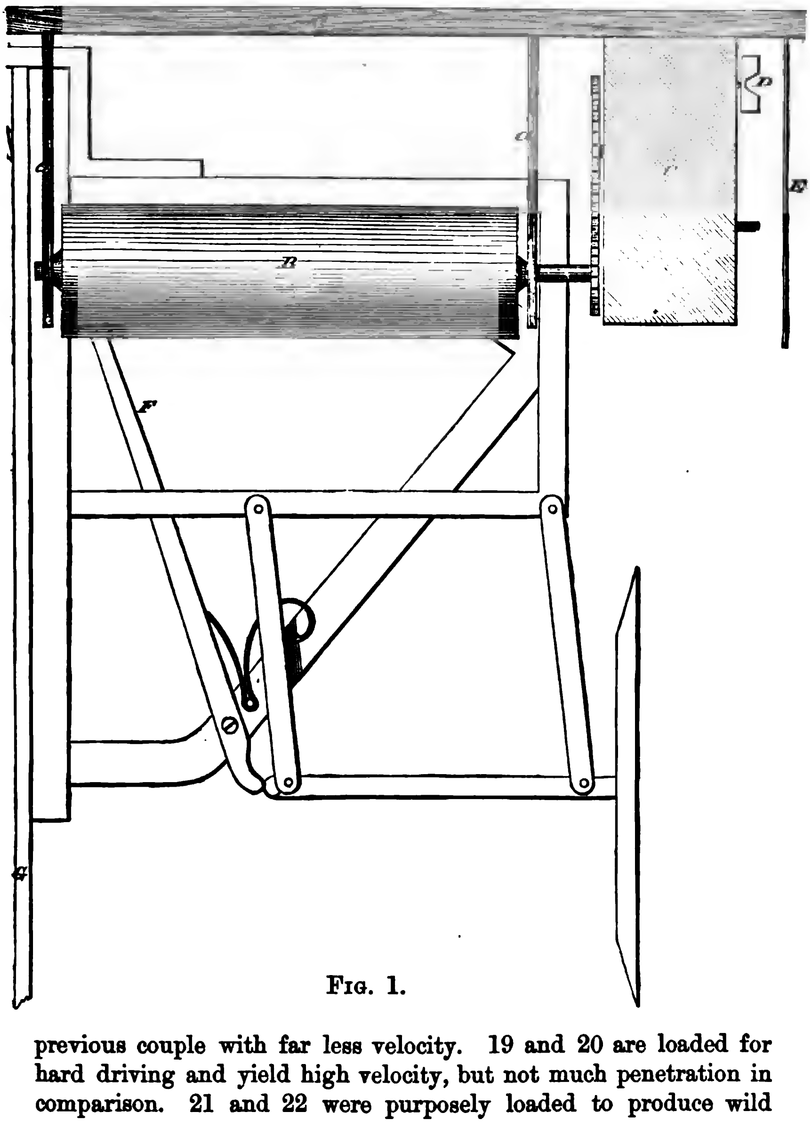


FIG. 1.

previous couple with far less velocity. 19 and 20 are loaded for hard driving and yield high velocity, but not much penetration in comparison. 21 and 22 were purposely loaded to produce wild

shots, and show their loading by the high velocity and wretched penetration.

To make the action of "scattered" shots on the plate plain at a glance, I fitted up a revolving cylinder, marked by a pencil actuated by the pointer arm of the force gauge, so that any vibration caused by the successive arrivals of scattered shots might be registered in a plain manner. The diagrams produced show the effect unmistakably. From a great number of curves produced, I have copied out a few characteristic ones.

The accompanying plans show the apparatus used for making the curves above alluded to.

Fig. 1 represents the cylinder and its motive power attached to the force gauge, which is bolted on to the target. *a* is supporting beam, carrying the cylinder and the supports to it; *B* is the revolving cylinder, made of polished yew wood; *C* is the clockwork driving the cylinder; *D* the little fan to regulate speed; *E* the sheet-iron apron in front of all to protect from shot.

Fig. 2 represents end view of cylinder and marking pencil. The

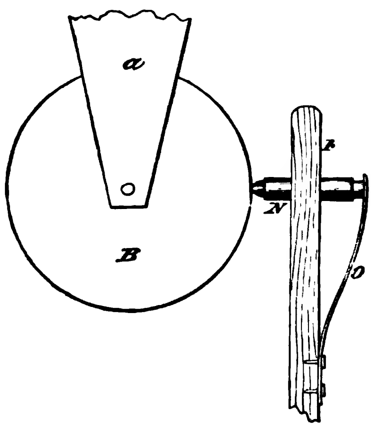



FIG. 2.

pencil of graphite slides in a tube *N*, and is pressed against the cylinder *B* by a spring *o*, thus maintaining equal pressure. The surface of the cylinder is coated with oil paint, which allows the pencil to travel over it without much friction, and marks very distinctly.

Fig. 3 shows reverse side of cylinder (the brass plate of gauge is supposed to be removed). *F* is the pointer arm carrying

the pencil; *B* the cylinder, on which I have drawn a curve as it appears when marked by a shot (*m*, *m*, *m*) in direction of arrow.

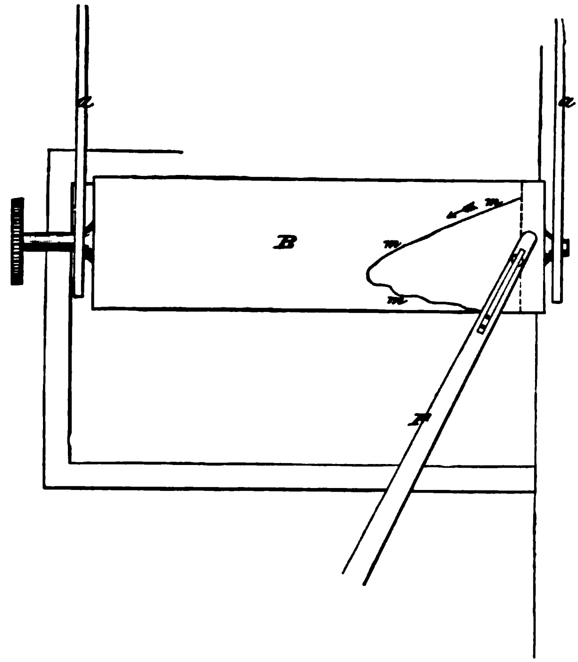



Fig. 3.

Fig. 4 shows small view of general appearance to front.

I may mention that the surface of the cylinder moved at the rate of about five feet per second, and the diagrams are reduced to about a quarter size. With a more elaborate arrangement it would be possible to measure the time between the first and last arrivals of pellets at the plate by the length of the line drawn while the plate is kept in vibration by the arrivals in succession.

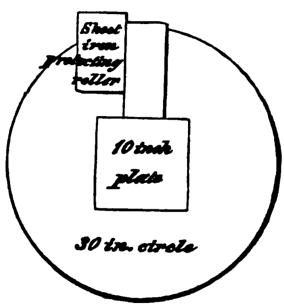
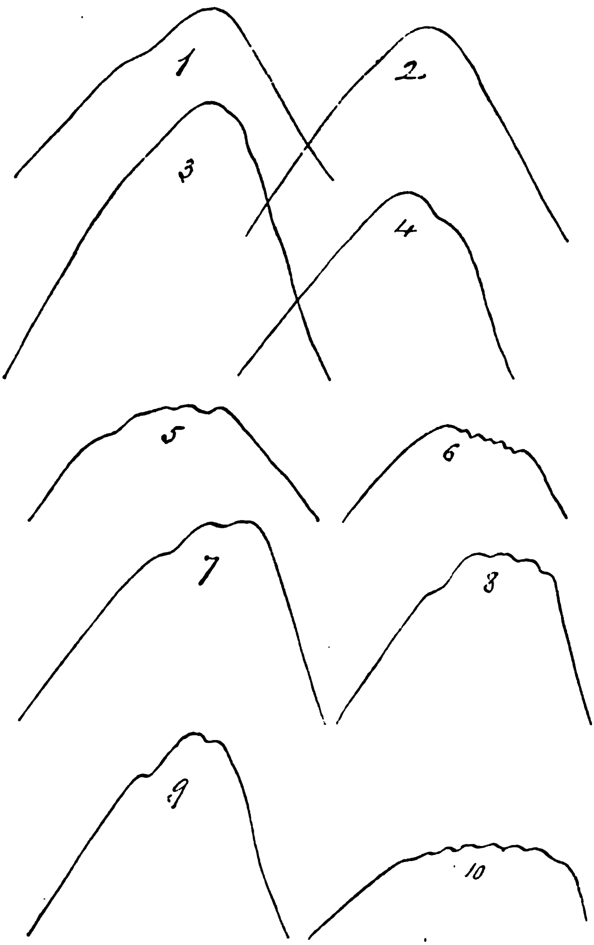



Fig. 4.

Diagram 1 is produced by loading such as No. 2 in table; diagram 2

by loading such as No. 9 ; diagram 3 by loading such as No. 15 ; and diagram 4 by loading such as No. 16. These represent steady shooting, when the pellets strike on the plate all together, and produce a steady run up of the pointer and recoil. Diagrams




5, 6, 7, and 8 represent shooting with loads such as Nos. 4, 8, 12, and 18 respectively, giving fairly good results, but not such penetration as they should, because all the pellets do not reach the plate together, and the late arrivals produce the vibratory

motion of the marker. Diagrams 9 and 10 represent loads such as Nos. 19 and 22 respectively, and are good samples, 9 of rather wild, and 10 of very wild shooting.

12-BORE C.F. GUN FULL CHOKE; Eley's green cases; shot chilled No. 6, 270 to ounce; distance 40 yards; shot from *Field* gun rest; penetration taken by force gauge; velocity by Boulengé chronograph.

| No. of Shot. | What Powder. | Charge Powder. | Wads. | Wads. | Shot charge. | Wad. | How turned over. | Gun recoil. | Pattern. | Pattern on 10in. | Gauge. | Penetration. | Velocity.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C. & H. | Drs. | Pink Ed. | Felt | | | | | | | | | |
| 1 | No. 4 | 3 | 11½ | ½ | 1⅛ oz. | Card | Well. | 84 | 197 | 36 | 80 | 2·22 | 860 |
| 2 | ... | 3 | ... | ... | ... | ... | ... | 84 | 184 | 42 | 85 | 2·02 | 862 |
| 3 | ... | 3¼ | ... | ... | ... | ... | ... | 94 | 146 | 21 | 40 | 1·90 | 908 |
| 4 | ... | 3½ | ... | ... | ... | ... | ... | 96 | 176 | 31 | 60 | 1·94 | 927 |
| | Do. Do. | | | | | | | | | | | | |
| 5 | No. 2 | 3 | ... | ... | ... | ... | ... | 89 | 148 | 26 | 50 | 1·92 | 888 |
| 6 | ... | 3 | ... | ... | ... | ... | ... | 88 | 176 | 34 | 61 | 1·79 | 908 |
| 7 | ... | 3¼ | ... | ... | ... | ... | ... | 95 | 161 | 31 | 65 | 2·10 | 932 |
| 8 | ... | 3½ | ... | ... | ... | ... | ... | 97 | 158 | 26 | 51 | 1·96 | 942 |
| 9 | Schult. | 3½ | ... | ... | ... | ... | ... | 68 | 206 | 50 | 101 | 2·02 | 815 |
| 10 | ... | 2¾ | ... | ... | ... | ... | ... | 69 | 182 | 43 | 85 | 1·98 | 805 |
| 11 | ... | 3 | ... | ... | ... | ... | ... | 76 | 202 | 43 | 89 | 2·07 | 893 |
| 12 | ... | 3 | ... | ... | ... | ... | ... | 78 | 192 | 48 | 103 | 2·15 | 910 |
| 13 | ... | 3 | ... | ... | ... | ... | Slightly. | 75 | 184 | 40 | 85 | 2·13 | 869 |
| 14 | ... | 3 | ... | ... | ... | ... | ... | 76 | 202 | 47 | 101 | 2·15 | 867 |
| 15 | ... | 3 | ... | ... | ... | ... | Not turned over | 74 | 227 | 64 | 143 | 2·23 | 858 |
| 16 | ... | 3 | ... | ... | ... | ... | ... | 74 | 209 | 42 | 93 | 2·21 | 862 |
| 17 | ... | 3¼ | ... | ... | ... | ... | Well | 86 | 165 | 28 | 62 | 2·21 | 934 |
| 18 | ... | 3½ | ... | ... | ... | ... | ... | 84 | 187 | 35 | 80 | 2·29 | 937 |
| 19 | ... | 3 | Pink Ed. 12 | Pink Ed. 12 | ... | Pink Edge | ... | 75 | 208 | 48 | 95 | 1·98 | 893 |
| 20 | ... | 3 | ... | ... | ... | ... | ... | 76 | 172 | 25 | 51 | 2·04 | 886 |
| †21 | ... | 3¼ | Card | Felt ½ | ... | ... | ... | 80 | 165 | 31 | 56 | 1·81 | 900 |
| †22 | ... | 3½ | ... | ... | ... | ... | ... | 79 | 140 | 22 | 41 | 1·86 | 895 |

* Velocity gives the mean velocity for 40 yards, in feet per second.

† Nos. 21 and 22 were loaded carelessly, purposely to get as wild shooting as I could.

12-BORE CYLINDER GUN; shot, cases, wads, distance, and conditions, same as with the choke-bore.

| No. of Shot. | What Powder. | Charge Powder. | Wads. | Wads. | Shot charge. | Wad. | How turned over. | Gun recoil. | Pattern. | Pattern on 10in. | Gauge. | Penetration. | Velocity. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C. & H. | Drs. | Pink Ed. | Felt | | | | | | | | | |
| 23 | No. 4. | 3 | 11½ | ½ | 1⅛oz. | Card | Well. | 83 | 112 | 22 | 38 | 1·73 | 865 |
| 24 | ... | 3 | ... | ... | ... | ... | ... | 85 | 93 | 19 | 35 | 1·84 | 874 |
| 25 | ... | 3¼ | ... | ... | ... | ... | ... | 95 | 78 | 16 | 29 | 1·81 | 927 |
| 26 | ... | 3½ | ... | ... | ... | ... | ... | 96 | 93 | 25 | 49 | 1·96 | 942 |
| 27 | Schult. | 3 | ... | ... | ... | ... | ... | 74 | 123 | 27 | 50 | 1·85 | 855 |
| 28 | ... | 3 | ... | ... | ... | ... | ... | 74 | 104 | 21 | 38 | 1·81 | 871 |
| 29 | ... | 3¼ | ... | ... | ... | ... | ... | 82 | 89 | 23 | 45 | 1·96 | 932 |
| 30 | ... | 3½ | ... | ... | ... | ... | ... | 84 | 79 | 15 | 28 | 1·87 | 930 |
| 31 | Schult. | 3 | ... | ... | ... | ... | ... | 76 | 37 | 8 | 10 | 1·25 | 788 |
| 32 | ... | ... | ... | ... | ... | ... | ... | 74 | 44 | 10 | 15 | 1·50 | 717 |

A comparison of these cylinder shots with the corresponding choke shots shows the *velocity* from the cylinder to be not inferior to that from choke-bore—indeed, with Curtis and Harvey's No. 4 we get superior velocity with the cylinder; with Schultze the choke gives the greater velocity. But the scattered manner in which the cylinder shots reach the 10in. plate tells greatly against them in "penetration." Only in one single instance do they equal the corresponding choke (No. 26 = 1·96, No. 4 = 1·94).

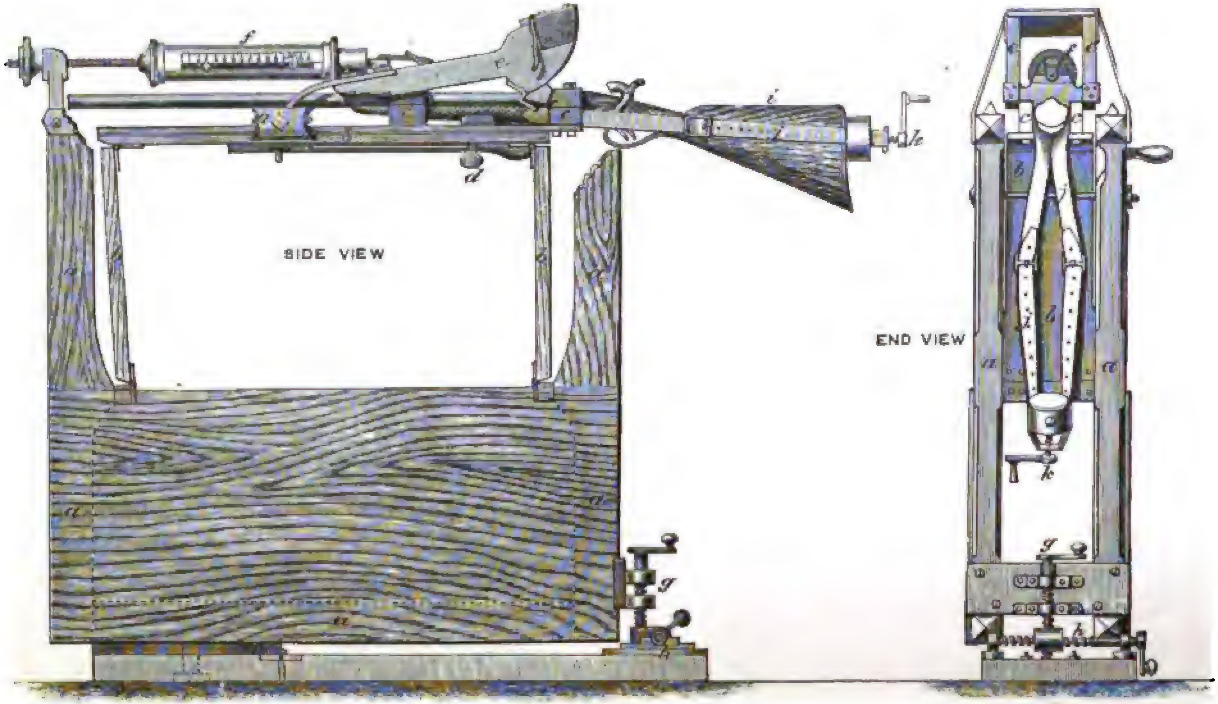
As will be anticipated, the curves produced by the cylinder gun are far more irregular and more deviating from a steady line than the curves produced by a choke gun. The cylinder curves all resemble curves 9 and 10; and some are even more uneven in appearance than those. Hence a cylinder gun may give to a few of the pellets as great a velocity as a choke does, but only to a few comparatively—the average falling short by a considerable degree. I am, of course, speaking of any ordinary cylinder gun, nothing special, but such as would pass as a fairly good shooting gun. What a specially prepared cylinder might do remains to be proved.

The last two shots (Nos. 31 and 32) are results of trials made with the endeavour to measure the velocity of the slower pellets from a cylinder gun. Judging that the *lowest* pellets in a pattern were the ones most likely to be the weakest in penetrative force, I adjusted the gauges so as to catch the outermost low pellets of the charge on the 10in. plates. The results are that the velocity of these weaker ones lags behind that of the central ones of the shot by about 140 feet per second, giving only 738 and 717 against 855 and 871. Owing to the closeness of the choke pattern, it is not easy to take the outer shots separately in this way from a choke bore.

Eyeworth Lodge, Lyndhurst. R. W. S. Griffith.

This is a very interesting series of experiments, not only in itself, but as proving the superiority of the force gauge over the Pettitt pad to which I have already alluded.

To make the trial of a gun thoroughly reliable and fit for comparison with previous public trials, the gun should be placed in a rest, because otherwise a good deal will depend on the skill and strength of the shooter. In 1878 I was first




"FIELD" GUN REST (INVENTED BY THE AUTHOR).

| | | |
|---|---|---|
| *a a a a* Solid frame made of ash. | *d* Screw for holder. | *g h* Horizontal and vertical adjustment screws. |
| *b b b b* Hinged parallel motion slide. | *e e e* Catch to prevent jar after recoil. | *i j* Stock and breeching strap. |
| *c c* Cork-lined gun holder. | *f f* Recoil gauge. | *k k* Tightener. |

*Face page*

enabled to construct such a machine, for up to that time it was considered impossible to make both barrels act on the same point without altering the rest, because the axis of the two converge, the muzzles being put nearer together than the breech ends, in order to counteract the yielding of the shoulder to the one-sided recoil. With the Whitworth rifle rest this deviation is not permitted, the slide being rigid; but by giving a certain amount of elasticity to the frame by making it of ash wood, and thus imitating the human shoulder, I was enabled to obtain a rest which would yield in the same manner to the shot, and yet afterwards return to its original position. A gun once properly fixed in it can be reloaded and fired indefinitely without readjustment, and, as proved by experiment, the results will be more favourable to the gun than if shot by the most skilful human "regulator." Its construction is as follows:

A hinged slide (*b*, *b*, *b*), made of mahogany, is fixed in an ash frame (*a*, *a*, *a*, *a*), which is strengthened below by a mahogany panel on each side firmly screwed on the outside. This ash frame is made of well-seasoned wood, 3 inches by 2 inches in substance, and securely fixed below to a metal wheel-plate, which again is bolted firmly to a strong cross-plank, screwed to the floor. This plank again is hinged to a longitudinal one, the two assuming the shape of the letter T. In the engraving the top of the ash frame is cut away to show the slide, but in reality it is continued to make up the square on each side. The next thing to be done is to fix the gun securely to the slide, which is effected by bolting to it two blocks (*c*, *c*) of ash, cut away to fit the barrels, against the top of which blocks the barrels are confined by the thumb-screw (*d*) acting on a movable padded clip. To prevent the recoil driving the gun backwards, a strong leather breech strap (*j*) is carried round the butt-end of the stock (*i*), and tightened by the screw (*k*), and this strap allows the breech-

loader to be opened and loaded without altering the aim. A locomotive steam gauge (*f*) is fixed to the ash frame and to the slide by which the amount of recoil is registered, the index (which is furnished with a tell-tale slide) being screwed up to 50 in order to give initial pressure and consequent steadiness of aim. To prevent disturbance after the recoil, a double wedge (*e*, *e*) is made, by means of indiarubber springs, to descend and arrest the slide, which is afterwards liberated by means of a long lever acting on a stud projecting below it. Lastly, regulating screws raise or depress as well as move laterally the whole ash frame, and with it the gun, on the wheel-plate by turning the handles, which will be readily seen in the engraving. Nothing could possibly act better than this machine; but, wood being affected by damp, it required from time to time the adjustment of the ash frame to the slide to allow it to travel freely, yet not too much so. This would be prevented if the framework of the slide were made of brass, which need not be very stout, and filled in with wood, by which means very little weight would be added. A metal cross-piece at each end should connect the two ash frames, and then there would be no attention needed to counteract the effects of damp. Mr. Jones has undertaken to make this rest as well as the force gauge, and he will no doubt effect this alteration, and render the rest complete.

Although I began to test the shot gun publicly in 1858, and have since then carried out other trials in 1859, 1866, 1875, 1876, 1878, and 1879, yet the conditions varied from time to time so considerably that it was almost impossible to ascertain whether or no any improvement had been effected upon the Joe Manton standard in point of penetration or pattern until the introduction of the choke bore in 1874. Up to that time every gunmaker admitted that, though he could increase his pattern up to about 130 or 140 with No. 6 shot in the 30-inch circle, it was at the expense of penetration, which

was reduced *pari passu* with the improved pattern. Beyond an average of 140 no one pretended to be able to go, and as far as public performances went the highest recorded average was 134, made by Mr. Pape in 1866, and that with one barrel only, the other making 117. At the same time Mr. W. Greener's highest average was 124·2. It is true that in private I obtained, some short time afterwards, an average pattern of 151 with my own Westley-Richards gun in a trial of Mr. C. Lancaster's concentrators. This was recorded in the *Field* of 1869, and as Mr. Lancaster was, of course, anxious to do justice to his own invention, his corroboration of my statement is to be accepted as undeniable. This gun was, however, a remarkable one, and with the exception of it, I have no proof of any increase of pattern until the 1874-5 trials when choke-bores were first publicly exhibited in this country. In the present day I am assured by several eminent gunmakers that they can always obtain a pattern of more than 140 with a true cylinder together with average penetration, but my experience does not go beyond Mr. Jeffries' pattern of 131·2 in 1875, and that of 139 which I obtained in the powder trial of 1878 from a gun made by Mr. Baker, and shot with 3¼drs. of Hall's powder, giving also a fairly good penetration, but not so high as with other powders which gave a worse pattern. Here, however, the test was with brown paper, and it is very possible that with the force gauge the result would have been different, the record being of three pellets only and not of 30 or thereabout, which the gauge would have given. On the whole it may be concluded that no great improvement on the plain cylinder barrel has been effected since 1866—in point of pattern or penetration; and as regards the former, the above results may be accepted as a stand-point, viz., an average pattern of 130, with 140 as an extraordinary one. The penetration of the cylinder may be put down as about 24 to 25 sheets of

Pettitt's pads, equivalent to about 1·80 to 1·90 of the force-gauge.

When the "choke-bore" was first tried by me in 1875 the Pettitt's pad was still the test of penetration, and the highest average was made by Mr. W. W. Greener, 34·41 sheets. Exclusive of Mr. Turner's gun (which was admitted to be a modified choke), the highest average penetration effected by a cylinder at the same trial was 28·66 sheets. Thus it at once appeared that the choke-bore not only gave any desired increase of pattern up to an average of 200 or thereabouts, but it also raised the penetration about one-fifth, or 8 yards in 40. It therefore appeared that, supposing the proper testing range with the cylinder to be 40 yards, that of the choke-bore should be 48, but nevertheless gunmakers have made no difference in this respect, and all guns not exceeding 12-bore are still tried at 40 yards. In 1878 I tested a gun of Mr. Greener's which had previously made an average pattern of 210·84, the result being an average of 153·80 at 50 yards, and 89·28 at 60 yards, showing a reduction of pattern to the extent of about one-fourth at 50 yards, and about three-sevenths at 60 yards.

Passing over the trial of 1878, which was one of powder rather than of guns, the last one held by me was that of 1879, which was set on foot in order to determine the relative powers of 12, 16, and 20-bores. Here some unexpected results came out, astonishing most sportsmen, including myself. It was supposed that the smaller bores would stand no chance whatever, either in penetration or pattern, the smaller charge of powder necessitated by the reduction of the chamber being expected to operate fatally against them. In this trial mere pattern was disregarded, the figure of merit being made up chiefly of penetration, from which was deducted (1) the variation of pattern; (2) the amount of recoil; and (3) the variation of recoil. Everything was therefore in favour

of the smaller bores, which, however, would have no chance if pattern formed an important feature in the figure of merit. For instance, a 16-bore is usually tried with 1oz. of shot, and a 20-bore with $\frac{7}{8}$oz., and consequently, as the latter only contains 234 pellets, it must put nearly every one of them on the 30inch plate in order to compete with the 12-bore, which has 70 pellets more in its charge and will give an average pattern of 210 to 230. No one, however, objected to the conditions until after the trial, when, of course, it was too late. Being made up of penetration and regularity of shooting combined, both the 16 and 20-bores of Mr. Green, of Cheltenham, beat all his competitors, including the 12-bores; but irrespective of regularity they had no chance. For instance, Mr. Greener, with his 12-bore obtained a penetration at 40 yards of 2·31, and Mr. Jeffries 2·38, as against Mr. Green's 16 and 20-bores, each of which scored 2·24 only. Again, as to pattern in the 12-bore class, Mr. Greener obtained an average of 204·20; Mr. Rosson, 206·84; Mr. Jeffries, 209·60; Messrs. Bland and Sons, 223·12; and Mr. Maleham, 224·48. In the 16 and 20-bores, however, Mr. Green's patterns were only 170·36 and 150·72; Mr. Maleham's 189·96 and 183·80. Mr. Greener's 161·48 and 152·20; Mr. Jeffries' 174·00 and 173·16; and Mr. Jones's 166·16 and 160·00 respectively. Before the trial took place I had reason to believe that regularity of shooting was the main desideratum in the gun; and the conditions were, I think, made to depend too much on this point. Still the "pop guns" showed a very high form, and in the hands of a good shot they may be trusted to kill nearly as well as the 12-bore, and, if he happens to be weak, especially in the arm, perhaps better.

The choke-bore is now an accepted fact, nineteen-twentieths of the guns sold being contracted at the muzzle more or less to suit the powers of their owners; but without a public

target trial it would have taken many years to establish their claims, in the face of the resistance offered to the new plan by nearly all the fashionable London makers. Clearly, therefore, I have established the efficiency of the trial by target, and it is now generally admitted that by it the shooting power of a gun, as compared either with the general average or with the best of its rivals, may be settled in a very short time. The only difficulty consists in the fairness of the person carrying out the trial, if he is furnished with the proper machines; and certainly most people would have more confidence in one not engaged in the trade rather than in a gunmaker, who might be considered as a rival of the maker of the gun submitted to him. At present, however, no such person has come forward, and the only means of testing guns of which I am aware are afforded by Mr. Leeson, gunmaker, of Ashford, Kent; Mr. Rosson, gunmaker, of Derby, and Mr. Jones, of Bath-street, Birmingham, who offer to undertake the task. Curiously enough, the two first-named assert that their machines, supplied by Mr. Jones, give more unfavourable records than that which I employed in the 1879 trials; but, after a careful examination of the asserted facts, I can only come to the conclusion that they are wrong, though I cannot tell how or why. Those of my readers who may be desirous of examining this subject for themselves may consult the columns of the *Field* for March and April, 1882, where they will find letters from Mr. Leeson, Mr. Rosson, and Mr. Jones.

In order to serve as a record, and for a comparison with future trials, either public or private, I append here the performances of the six best guns in 1875, 1878, and 1879, omitting the trial of 1866, in which the penetration was calculated by multiplying by six the number of sheets in the Pettitt pad broken by one pellet, instead of that broken by three pellets, which since that time has been adopted. This

change makes a difference of about four or five sheets, and it is well therefore to discard the 1866 trial from our calculation on that account. The 1875-8 trials are useful to those who still resort to the Pettitt pad, while the 1879 trial will serve the patrons of the force gauge. In all three trials the pattern was taken from the actual 30-inch plate, and not from a "selected group" often used by gunmakers, as remarked at page 33.

## FIELD TRIAL OF 1875.

GUNS ALL SHOT FROM THE SHOULDER.—1⅛OZ. NO. 6 SHOT.

### I.—CHOKE BORES.

| | Average Pattern. | | Sheets pierced. | | Penetration. | | Fig. of Merit. |
|---|---|---|---|---|---|---|---|
| Mr. W. W. Greener ... | 199·0 | + | 34·41 × 6 | = | 206·5 | = | 405·5 |
| Mr. Pape .................. | 182·2 | + | 33·41 × 6 | = | 200·5 | = | 382·7 |
| Mr. Davison............... | 179·5 | + | 32·83 × 6 | = | 197·0 | = | 376·5 |
| Mr. Baker ............... | 175·5 | + | 32·66 × 6 | = | 196·0 | = | 371·5 |
| Mr. Baker ............... | 176·5 | + | 31·33 × 6 | = | 188·0 | = | 364·5 |
| Mr. Green ............... | 171·8 | + | 31·50 × 6 | = | 189·0 | = | 360·8 |
| Average ...... | 180·75 | | 32·69 | | 196·14 | | 376·89 |

### II.—CYLINDER GUNS.

Conditions as for Choke Bores.

| | Average Pattern. | | Sheets pierced. | | Penetration. | | Fig. of Merit. |
|---|---|---|---|---|---|---|---|
| Mr. Davison............... | 122·4 | + | 28·66 × 6 | = | 172·0 | = | 294·4 |
| Mr. W. W. Greener ... | 125·5 | + | 26·75 × 6 | = | 160·5 | = | 286·0 |
| Mr. Jeffries ............... | 131·2 | + | 24·47 × 6 | = | 146·8 | = | 278·0 |
| Mr. Maleham ........... | 119·7 | + | 26·17 × 6 | = | 157·0 | = | 276·7 |
| Mr. Turner* ........... | 101·5 | + | 28·66 × 6 | = | 172·0 | = | 273·5 |
| Mr. Davison ........... | 125·2 | + | 24·50 × 6 | = | 147·0 | = | 272·2 |
| Average ...... | 120·92 | | 26·53 | | 159·21 | | 280·13 |

* Mr. Turner won the cup with this gun, but, being admittedly a modified choke, and its winning performance depending upon its shooting with a selected group, I have classed it here under its performance with the ordinary group.

## FIELD TRIAL OF 1878.

Conditions as to shot, the same as in 1875, but all guns were fired from the machine-rest described at page 48. In this trial, the guns were specially bored to suit the powder-makers by whom they were ordered.

### I.—CHOKE BORES.

| | Average Pattern. | | Sheets pierced. | | Penetration. | | Fig. of Merit. |
|---|---|---|---|---|---|---|---|
| Mr. W. W. Greener | 205·29 | + | 26·04 × 6 | = | 156·24 | = | 361·53 |
| Mr. W. W. Greener | 197·71 | + | 25·27 × 6 | = | 151·64 | = | 349·35 |
| Mr. W. W. Greener | 192·91 | + | 25·85 × 6 | = | 155·12 | = | 348·03 |
| Mr. Maleham......... | 186·96 | + | 24·45 × 6 | = | 146·68 | = | 333·64 |
| Mr. Maleham......... | 185·93 | + | 23·95 × 6 | = | 143·68 | = | 329·61 |
| Mr. Maleham......... | 173·56 | + | 23·98 × 6 | = | 143·88 | = | 317·44 |
| Average ...... | 190·39 | | 24·92 | | 149·54 | | 339·93 |
| Average in 1875 ... | 180·75 | | 32·69 | | 196·14 | | 376·89 |

### II.—CYLINDERS.

Conditions as for Choke Bores.

| | Average Pattern. | | Sheets pierced. | | Penetration. | | Fig. of Merit. |
|---|---|---|---|---|---|---|---|
| Mr. Maleham......... | 129·52 | + | 23·46 × 6 | = | 140·76 | = | 270·28 |
| Mr. Baker ............ | 128·57 | + | 23·42 × 6 | = | 140·52 | = | 269·09 |
| Mr. Baker ............ | 127·58 | + | 23·37 × 6 | = | 140·24 | = | 267·82 |
| Mr. Powell............ | 126·51 | + | 22·40 × 6 | = | 134·44 | = | 260·95 |
| Mr. Baker ............ | 111·05 | + | 23·37 × 6 | = | 140·20 | = | 251·25 |
| Mr. W. W. Greener | 110·89 | + | 21·70 × 6 | = | 130·16 | = | 241·05 |
| Average ...... | 122·35 | | 22·95 | | 137·72 | | 260·07 |
| Average in 1875 ... | 120·92 | | 26·53 | | 159·21 | | 280·13 |

It would appear from the above comparisons, that, though the choke-bores of 1878 were improved in pattern over those of 1875 by 9·64, they had fallen off in penetration nearly 8 sheets, viz., from 196·14 (32·69 sheets) to 149·54 (24·92 sheets). On the other hand, while the cylinders had only improved in pattern 1·43, they had fallen off in penetration by not quite 4 sheets, viz., from 159·21 (26·53 sheets) to 137·72 (22·95 sheets). That there was a difference in the paper used on the two occasions is pretty clear, but the same being used

for both classes in each trial, there must be some other cause for the greater difference in the choke-bores. This decrease is probably in some measure due to the fact that in 1878 regularity of pattern was made an important factor in the figure of merit, which probably induced the gunmakers to sacrifice penetration to it; first, in the boring of their guns; and, secondly, in the charges of powder used—which it was known would cause irregularity if much raised beyond 3drs.; and, in fact, no gun was shot in 1878 with 3½drs. of powder, as was several times done in 1875. But on actually testing the 1878 pads with Mr. Rigby's gun, which was tried in 1875, its penetration was 144 in 1878, against 170·1 in 1875, showing a diminution of about four sheets.

## FIELD TRIAL OF 1879.

In the 1879 trial, cylinders were not tested at all, the competition being between 12, 16, and 20 bores, all choked. At that time it had not been publicly demonstrated that regularity of shooting could be generally obtained with the choke-bore, although in private I had satisfied myself of the fact. As a consequence, the conditions were framed nearly on the same basis as in 1878, but the variation in pattern was that between the average deviation and the declared pattern, and not, as in 1878, between the lowest and the average pattern. The recoil gauge was also screwed up to 60lb. instead of 30lb.

The alteration as to pattern affects the test considerably, and advantageously to the gunmaker; for it was found to be possible to declare the final pattern within a small margin. In Mr. Greener's winning 12-bore gun, the difference from the declared pattern was only 4·20; in Mr. Jeffries, 9·60: and in Mr. Rosson's 6·84; but Mr. Leeson's gun differed 26; Mr. Maleham's 24·48; Messrs. Trulock and Harris's 29·80; and Messrs. Bland and Sons 48·12. Assuming this change to have no effect—and in the three highest it had none worth

consideration—there was no improvement in regularity, but rather the reverse, as will be seen. Omitting the trials with Schultze powder, in which the irregularity was the cause of its want of complete success, the variations were as follows :

TABLE OF VARIATIONS IN 1878.

Showing the variations, of the lowest pattern from the average pattern, made by the six choke-bore guns shot with three black powders in each case.

| GUN. | Shot with C. & H. Powder. | Shot with Pigou & Wilks Powder. | Shot with J. Hall & Sons Powder. |
|---|---|---|---|
| Curtis and Harvey—made by Maleham. | 52·44 | 86·60 | 75·28 |
| John Hall and Sons—made by Maleham. | 141·48 | 37·28 | 136·80 |
| Pigou and Wilks—made by Greener. | 24·08 | 38·84 | 47·04 |
| Schultze Company—made by Maleham. | 61·84 | 70·36 | 105·28 |
| Ditto by Greener ...... | 60·80 | 83·52 | 50·24 |
| Ditto by Greener ...... | 75·16 | 89·32 | 52·20 |
| Average | 69·30 | 67·65 | 77·81 |

Total Average .................... 71·59.

As there was no declared pattern in 1878, it is not possible to compare the guns of 1879 with those of 1878 on that calculation; and, in order to make any comparison, we are therefore compelled to ascertain the irregularity in the 1879 guns on the plan adopted in 1878, the result being as follows :

| Gun. | Variation as recorded in 1879. | Variation on the plan adopted in 1878. |
|---|---|---|
| Mr. W. W. Greener ......... | 21·32 | 55·20 |
| Mr. Jeffries .................... | 26·64 | 121·60 |
| Mr. Rosson .................... | 21·64 | 89·84 |
| Mr. Leeson ........................ | 31·04 | 113·00 |
| Mr. Maleham .................... | 32·32 | 94·48 |
| Trulock and Harris ............ | 37·32 | 74·80 |
| Average.............. | 28·38 | 91·49 |

From this it appears that, taking the average of the six choke-bore guns shot with black powder in 1878 at 71·59, and that of the six test guns shot in 1879 at 91·49, the 1878 guns beat the 1879 guns in regularity by 19·90.

But whether more or less in the respective trials it was demonstrated that the irregularity so much relied on by the opponents of the choke-bore is not very great, and since that time it has still further diminished chiefly by means of the more careful wadding and filling of cartridge cases. While, therefore, regularity may be made an element in comparing choke-bores with cylinders or choke-bores among their own class, it is useless to import it into the comparison of large with small bores, all being choked. For these reasons I have eliminated it from the scores recorded of the 1879 trial in the following tables:

In the cylinder trial of 1878 the differences were as follows:

| Gun. | Shot with C. & H. Powder. | Shot with Pigou & Wilks Powder. | Shot with Hall & Sons Powder. |
|---|---|---|---|
| Curtis and Harvey—made by Baker. | 61·00 | 40·52 | 57·80 |
| Hall and Sons—made by Baker. | 83·88 | 45·60 | 26·40 |
| Pigou and Wilks—made by Greener. | 65·92 | 57·52 | 74·60 |
| Schultze Company—made by Maleham. | 73·60 | 42·32 | 75·16 |
| Ditto by Powell & Sons | 42·44 | 62·60 | 49·16 |
| Ditto by Baker ........ | 84·84 | 53·44 | 49·08 |
| Average | 68·61 | 50·33 | 55·37 |

Total Average of cylinder.......................... 58·10
Total Average of choke-bores .................... 71·59

The irregularity of the choke-bores was therefore greater by 13·49.

## SCORES MADE IN THE 1879 TRIAL.

The following tables give the details of the scores at 40 yards, together with the figures of merit which were calculated on the plan above mentioned. In the trial itself the guns came out in the order given below, the figure of merit being founded on the performances at 40 and 60 yards combined.

The conditions in all the classes were, (1) unlimited use of powder; (2) the the charge of shot not to exceed 1⅛oz. for the 12-bores, 1oz. for the 16-bores, and ⅞oz. for the 20-bores, the pattern to be declared before shooting; but it was allowed to be postponed till after the trial shots were taken, often six or eight.

### Class I.—For 12-Bores.

**12-BORE GUN, made by W. W. Greener; weight 7¼lb.; length of barrel, 30in.; make of barrel, English laminated; shot with 3¼drs. of Pigou and Wilks's No. 4 powder; declared pattern, 200.**

| Left Barrel. Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. | Right Barrel. Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 70 | 2·33 | 30 | 149 | 51 | 110 | 148 | 2·43 | 61 | 241 | 41 | 110 |
| 120 | 2·14 | 56 | 207 | 7 | 116 | 165 | 2·66 | 62 | 237 | 37 | 110 |
| 103 | 2·19 | 47 | 221 | 21 | 111 | 107 | 2·23 | 48 | 188 | 12 | 110 |
| 73 | 2·28 | 32 | 152 | 48 | 112 | 159 | 2·52 | 63 | 208 | 8 | 110 |
| 90 | 2·31 | 39 | 170 | 30 | 112 | 118 | 2·31 | 51 | 225 | 25 | 110 |
| 80 | 2·29 | 35 | 195 | 5 | 112 | 83 | 1·93 | 43 | 208 | 8 | 110 |
| 130 | 2·36 | 55 | 221 | 21 | 110 | 182 | 2·68 | 68 | 232 | 32 | 111 |
| 104 | 2·12 | 49 | 206 | 6 | 114 | 178 | 2·70 | 66 | 216 | 16 | 110 |
| 90 | 2·20 | 41 | 185 | 15 | 112 | 149 | 2·53 | 59 | 226 | 26 | 110 |
| 109 | 2·14 | 51 | 225 | 25 | 112 | 105 | 2·14 | 49 | 221 | 21 | 110 |
| 127 | 2·35 | 54 | 211 | 11 | 113 | 125 | 2·27 | 55 | 232 | 32 | 110 |
| 140 | 2·26 | 62 | 231 | 31 | 114 | 88 | 2·10 | 42 | 201 | 1 | 110 |
| 98 | 2·33 | 42 | 197 | 3 | 112 | | | | | | |
| Total of both barrels | | | | | | | 57·80 | ... | 5105 | 533 | 2781 |
| Average of 25 shots | | | | | | | 2·3120 | ... | 204·20 | 21·32 | 111·24 |

Average force per pellet ........ 231·20
(Average pattern, 204·20.)
Average of the deviations of patterns from declared pattern ........ 21·32
Average recoil above 80lb ........ 31·24
Difference between highest and lowest recoils ........ 6·00
} 58·56

Figure of Merit ........ 172·64

**12-BORE GUN**, made by LINCOLN JEFFRIES; weight, 6lb. 14oz.; length of barrel, 30in.; make of barrel, English Damascus; shot with 3¼drs. of Curtis's and Harvey's No. 4 powder; declared pattern, 200.

| LEFT BARREL. Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. | RIGHT BARREL. Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 107 | 2·33 | 46 | 204 | 4 | 110 | 91 | 2·27 | 40 | 194 | 6 | 109 |
| 91 | 2·07 | 44 | 200 | 0 | 113 | 151 | 2·52 | 60 | 238 | 38 | 110 |
| 108 | 2·25 | 48 | 215 | 15 | 111 | 241 | 2·84 | 85 | 231 | 31 | 110 |
| 89 | 2·12 | 42 | 230 | 30 | 110 | 195 | 2·71 | 72 | 242 | 42 | 110 |
| 123 | 2·26 | 56 | 239 | 39 | 111 | 98 | 2·33 | 42 | 204 | 4 | 110 |
| 96 | 2·29 | 42 | 214 | 14 | 114 | 178 | 2·62 | 68 | 213 | 13 | 118 |
| 97 | 2·26 | 43 | 209 | 9 | 116 | 175 | 2·61 | 67 | 250 | 50 | 110 |
| 159 | 2·48 | 64 | 218 | 18 | 113 | 88 | 2·20 | 40 | 196 | 4 | 118 |
| 96 | 2·23 | 43 | 203 | 3 | 110 | 78 | 2·23 | 35 | 169 | 31 | 111 |
| 117 | 2·25 | 52 | 212 | 12 | 111 | 176 | 2·59 | 68 | 249 | 49 | 110 |
| 90 | 2·20 | 41 | 173 | 27 | 112 | 164 | 2·88 | 57 | 252 | 52 | 110 |
| 186 | 2·45 | 76 | 230 | 30 | 112 | 91 | 2·12 | 43 | 167 | 33 | 110 |
| 42 | 2·63 | 16 | 88 | 112 | 112 | | | | | | |
| Total of both barrels | | | | | | | 59·68 | ... | 5240 | 666 | 2791 |
| Average of 25 shots | | | | | | | 2·3872 | ... | 209·60 | 26·64 | 111·64 |

Average force per pellet ........ 238·72
(Average pattern, 209·60).
Average of the deviations of patterns from declared pattern ........ 26·64
Average recoil above 80lb ........ 31·64
Difference between highest and lowest recoils ........ 9·00
} 67·28

Figure of Merit........ 171·44

**12-BORE GUN**, made by C. ROSSON; weight, 7¼lb.; length of barrel, 30in.; make of barrel, English laminated; shot with 3¼drs. of Pigou and Wilks's No. 4 powder; declared pattern, 200.

| LEFT BARREL. Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. | RIGHT BARREL. Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 121 | 2·12 | 57 | 117 | 83 | 108 | 81 | 2·13 | 38 | 214 | 14 | 112 |
| 79 | 2·19 | 36 | 193 | 7 | 110 | 168 | 2·47 | 68 | 241 | 41 | 108 |
| 107 | 2·23 | 48 | 257 | 57 | 108 | 133 | 2·29 | 58 | 205 | 5 | 108 |
| 112 | 2·29 | 49 | 235 | 35 | 110 | 103 | 2·29 | 45 | 213 | 13 | 109 |
| 56 | 2·24 | 25 | 160 | 40 | 114 | 136 | 2·27 | 60 | 209 | 9 | 108 |
| 91 | 2·22 | 41 | 208 | 8 | 110 | 141 | 2·39 | 59 | 217 | 17 | 108 |
| 101 | 2·30 | 44 | 167 | 33 | 117 | 88 | 2·10 | 42 | 215 | 15 | 109 |
| 120 | 2·10 | 57 | 208 | 8 | 107 | 118 | 2·31 | 51 | 206 | 6 | 108 |
| 106 | 2·04 | 52 | 196 | 4 | 112 | 133 | 2·33 | 57 | 233 | 33 | 107 |
| 134 | 2·16 | 62 | 227 | 27 | 108 | 86 | 2·26 | 38 | 190 | 10 | 110 |
| 81 | 2·13 | 38 | 216 | 16 | 108 | 87 | 2·17 | 40 | 192 | 8 | 106 |
| 91 | 2·22 | 41 | 210 | 10 | 110 | 92 | 2·30 | 40 | 211 | 11 | 108 |
| 116 | 2·23 | 52 | 231 | 31 | 109 | | | | | | |
| Total of both barrels | | | | | | | 55·78 | ... | 5171 | 541 | 2732 |
| Average of 25 shots | | | | | | | 2·2312 | ... | 206·84 | 21·64 | 109·28 |

Average force per pellet ........ 223·12
(Average pattern, 206·84.)
Average of the deviations of patterns from declared pattern ........ 21·64
Average recoil above 80lb. ........ 29·28
Difference between highest and lowest recoils ........ 11·00
} 61·92

Figure of Merit ........ 161·20

12-BORE GUN, made by W. R. Leeson; weight, 6lb. 7oz.; length of barrel. 30in.; make of barrel, English hardened Damascus; shot with 3¼drs. of Curtis's and Harvey's coarse-grain basket powder; declared pattern, 200.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 90 | 2·37 | 38 | 193 | 7 | 114 | 129 | 2·43 | 53 | 205 | 5 | 110 |
| 105 | 2·28 | 46 | 219 | 19 | 110 | 58 | 2·32 | 25 | 138 | 62 | 111 |
| 97 | 2·21 | 44 | 186 | 14 | 110 | 82 | 2·28 | 36 | 195 | 5 | 110 |
| 84 | 2·47 | 34 | 182 | 18 | 111 | 59 | 2·27 | 26 | 150 | 50 | 111 |
| 96 | 2·23 | 43 | 199 | 1 | 111 | 65 | 2·17 | 30 | 169 | 31 | 111 |
| 49 | 2·45 | 20 | 95 | 105 | 111 | 13 | 1·62 | 8 | 68 | 132 | 110 |
| 91 | 2·07 | 44 | 198 | 2 | 112 | 14 | 1·55 | 9 | 61 | 139 | 110 |
| 71 | 2·45 | 29 | 171 | 29 | 112 | 119 | 2·43 | 49 | 195 | 5 | 111 |
| 79 | 2·32 | 34 | 183 | 17 | 112 | 118 | 2·31 | 51 | 207 | 7 | 111 |
| 162 | 2·45 | 66 | 216 | 16 | 113 | 80 | 2·16 | 37 | 188 | 12 | 114 |
| 88 | 2·44 | 36 | 182 | 18 | 114 | 97 | 2·21 | 44 | 216 | 16 | 111 |
| 83 | 2·18 | 38 | 156 | 44 | 113 | 71 | 2·22 | 32 | 192 | 8 | 111 |
| 95 | 2·44 | 39 | 186 | 14 | 114 | | | | | | |
| Total of both barrels | | | | | | | 56·33 | ... | 4350 | 776 | 2788 |
| Average of 25 shots | | | | | | | 2·2532 | ... | 174·00 | 31·04 | 111·52 |

Average force per pellet ........ 225·32
(Average pattern, 174·00).

| | | |
|---|---|---|
| Average of the deviations of patterns from declared pattern ........ | 31·04 | 66·56 |
| Average recoil above 80lb. ........ | 31·52 | |
| Difference between highest and lowest recoils ........ | 4·00 | |

Figure of Merit ........ 158·76

12-BORE GUN, made by C. H. Maleham; weight 7lb. 3oz.; length of barrel, 30in.; make of barrel, English steel; shot with 3drs. of Curtis's and Harvey's No. 6 powder; declared pattern, 200.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 130 | 2·13 | 61 | 228 | 28 | 118 | 151 | 2·22 | 68 | 242 | 42 | 118 |
| 151 | 2·22 | 68 | 254 | 54 | 116 | 119 | 2·13 | 56 | 225 | 25 | 110 |
| 61 | 2·44 | 25 | 130 | 70 | 112 | 154 | 2·41 | 64 | 226 | 26 | 114 |
| 157 | 2·27 | 69 | 251 | 51 | 104 | 86 | 2·05 | 42 | 216 | 16 | 106 |
| 110 | 2·04 | 54 | 224 | 24 | 104 | 100 | 2·22 | 45 | 221 | 21 | 106 |
| 172 | 2·32 | 74 | 238 | 38 | 106 | 134 | 2·13 | 63 | 239 | 39 | 105 |
| 85 | 2·07 | 41 | 208 | 8 | 104 | 140 | 2·26 | 62 | 220 | 20 | 102 |
| 97 | 2·16 | 45 | 210 | 10 | 105 | 190 | 2·71 | 70 | 255 | 55 | 105 |
| 108 | 2·08 | 52 | 222 | 22 | 106 | 82 | 2·28 | 36 | 172 | 28 | 103 |
| 115 | 2·05 | 56 | 243 | 43 | 104 | 135 | 2·25 | 60 | 231 | 31 | 104 |
| 131 | 2·08 | 63 | 234 | 34 | 106 | 93 | 2·32 | 40 | 209 | 9 | 106 |
| 131 | 1·96 | 67 | 229 | 29 | 105 | 153 | 2·51 | 61 | 239 | 39 | 105 |
| 140 | 2·19 | 64 | 246 | 46 | 106 | | | | | | |
| Total of both barrels | | | | | | | 55·50 | ... | 5612 | 808 | 2680 |
| Average of 25 shots | | | | | | | 2·2200 | ... | 224·48 | 32·32 | 107·20 |

Average force per pellet ........ 222·00
(Average pattern, 224·48.)

| | | |
|---|---|---|
| Average of the deviations of patterns from declared pattern ........ | 32·32 | 75·52 |
| Average recoil above 80lb. ........ | 27·20 | |
| Difference between highest and lowest recoils ........ | 16·00 | |

Figure of Merit ........ 146·48

12-BORE GUN, made by Trulock and Harris; weight, 7¼lb.; length of barrel, 30in.; make of barrel, English laminated; shot with 3¼drs. of Pigou and Wilks's No. 4 powder; declared pattern, 182.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 131 | 2·18 | 60 | 228 | 46 | 108 | 74 | 2·00 | 37 | 181 | 1 | 108 |
| 185 | 2·43 | 76 | 235 | 53 | 108 | 125 | 1·69 | 74 | 244 | 62 | 107 |
| 157 | 2·38 | 66 | 239 | 57 | 120 | 124 | 2·30 | 54 | 225 | 43 | 120 |
| 102 | 2·32 | 44 | 203 | 21 | 120 | 64 | 2·06 | 31 | 166 | 16 | 120 |
| 90 | 2·20 | 41 | 174 | 8 | 120 | 124 | 2·34 | 53 | 239 | 57 | 119 |
| 83 | 2·31 | 36 | 158 | 24 | 119 | 115 | 2·17 | 53 | 250 | 68 | 118 |
| 116 | 2·27 | 51 | 205 | 23 | 119 | 115 | 2·17 | 53 | 220 | 38 | 118 |
| 147 | 2·33 | 63 | 218 | 36 | 120 | 118 | 2·27 | 52 | 232 | 50 | 117 |
| 115 | 2·13 | 54 | 227 | 45 | 118 | 124 | 2·14 | 58 | 234 | 52 | 116 |
| 74 | 2·24 | 33 | 137 | 45 | 115·5 | 164 | 2·60 | 63 | 221 | 39 | 115 |
| 98 | 2·18 | 45 | 206 | 24 | 116 | 167 | 2·39 | 70 | 230 | 48 | 116 |
| 120 | 2·27 | 53 | 212 | 30 | 120 | 155 | 2·63 | 59 | 219 | 37 | 120 |
| 100 | 2·13 | 47 | 192 | 10 | 118 | | | | | | |
| Total of both barrels | | | | | | | 56·13 | ... | 5295 | 933 | 2915·5 |
| Average of 25 shots | | | | | | | 2·2452 | ... | 211·80 | 37·32 | 116·62 |

| | | |
|---|---|---|
| Average force per pellet ........................ | | 224·52 |
| (Average pattern, 211·80). | | |
| Average of the deviations of patterns from declared pattern ........................ | 37·32 | 86·94 |
| Average recoil above 80lb. ........................ | 36·62 | |
| Difference between highest and lowest recoils ......... | 13·00 | |
| Figure of Merit ........................ | | 137·58 |

## Class II.—For 16-Bores.

16-BORE GUN, made by E. C. Green; weight, 6¼lb.; length of barrel, 30in.; make of barrel, English Damascus; shot with 2¼drs. of Curtis's and Harvey's No. 4 powder, ⅞oz. shot; declared pattern, 165.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot | Diff. | Recoil. |
| 68 | 2·27 | 30 | 130 | 35 | 98 | 93 | 2·11 | 44 | 172 | 7 | 100 |
| 91 | 2·22 | 41 | 167 | 2 | 100 | 120 | 2·27 | 53 | 175 | 10 | 100 |
| 104 | 2·26 | 46 | 175 | 10 | 100 | 72 | 2·18 | 33 | 182 | 17 | 101 |
| 85 | 2·58 | 33 | 140 | 25 | 101 | 124 | 2·43 | 51 | 184 | 19 | 98 |
| 93 | 2·02 | 46 | 181 | 16 | 98 | 85 | 2·24 | 38 | 181 | 16 | 99 |
| 88 | 2·15 | 41 | 156 | 9 | 97 | 72 | 2·32 | 31 | 151 | 14 | 101 |
| 62 | 2·30 | 27 | 157 | 8 | 99 | 87 | 2·07 | 42 | 188 | 23 | 97 |
| 75 | 2·42 | 31 | 180 | 15 | 98 | 80 | 2·22 | 36 | 187 | 22 | 98 |
| 92 | 2·14 | 43 | 160 | 5 | 101 | 61 | 2·26 | 27 | 162 | 3 | 100 |
| 98 | 2·18 | 45 | 187 | 22 | 98 | 70 | 2·12 | 33 | 148 | 17 | 102 |
| 86 | 2·39 | 36 | 162 | 3 | 100 | 85 | 2·24 | 38 | 200 | 35 | 98 |
| 88 | 2·26 | 39 | 190 | 25 | 99 | 89 | 2·34 | 38 | 185 | 20 | 98 |
| 91 | 2·12 | 43 | 159 | 6 | 100 | | | | | | |
| Total of both barrels | | | | | | | 56·11 | ... | 4259 | 384 | 2481 |
| Average of 25 shots | | | | | | | 2·2444 | ... | 170·36 | 15·36 | 99·24 |

| | | |
|---|---|---|
| Average force per pellet ........................ | | 224·14 |
| (Average pattern, 170·36.) | | |
| Average of the deviations of patterns from declared pattern ........................ | 15·36 | 39·60 |
| Average recoil above 80lb. ........................ | 19·24 | |
| Difference between the highest and lowest recoils ... | 5·00 | |
| Figure of Merit ........................ | | 184·84 |

16-BORE GUN, made by LINCOLN JEFFRIES; weight, 5lb. 11oz.; length of barrel, 29½in.; make of barrel, English Damascus; shot with 2¾drs. of Curtis's and Harvey's No. 4 powder; declared pattern, 171.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 79 | 2·55 | 31 | 190 | 19 | 105 | 84 | 2·15 | 39 | 178 | 7 | 105 |
| 85 | 2·18 | 39 | 167 | 4 | 105 | 66 | 2·00 | 33 | 169 | 2 | 104 |
| 80 | 2·11 | 38 | 169 | 2 | 105 | 104 | 2·12 | 49 | 193 | 22 | 106 |
| 70 | 2·50 | 28 | 135 | 36 | 108 | 68 | 2·34 | 29 | 142 | 29 | 106 |
| 97 | 2·21 | 44 | 184 | 13 | 107 | 66 | 2·28 | 29 | 175 | 4 | 107 |
| 77 | 2·33 | 33 | 146 | 25 | 107 | 70 | 2·12 | 33 | 168 | 3 | 105 |
| 84 | 2·40 | 35 | 165 | 6 | 107 | 119 | 2·48 | 48 | 181 | 10 | 108 |
| 88 | 2·15 | 41 | 177 | 6 | 107 | 94 | 2·19 | 43 | 193 | 22 | 108 |
| 80 | 2·35 | 34 | 170 | 1 | 108 | 103 | 2·06 | 50 | 201 | 30 | 108 |
| 58 | 2·32 | 25 | 116 | 55 | 107 | 127 | 2·31 | 55 | 208 | 37 | 106 |
| 84 | 2·10 | 40 | 171 | 0 | 107 | 95 | 2·11 | 45 | 197 | 26 | 105 |
| 90 | 2·20 | 41 | 178 | 7 | 107 | 100 | 1·96 | 51 | 194 | 23 | 109 |
| 74 | 2·18 | 34 | 183 | 12 | 107 | | | | | | |
| Total of both barrels | | | | | | | 55·70 | ... | 4350 | 401 | 2664 |
| Average of 25 shots | | | | | | | 2·2280 | ... | 174·00 | 16·04 | 106·56 |

Average force per pellet ........................ 222·80
(Average pattern, 174·00.)
Average of the deviations of patterns from declared pattern ........ 16·04
Average recoil above 80lb. ........ 26·56
Difference between highest and lowest recoils ........ 5·00
} 47·60

Figure of Merit ........................ 175·20

16-BORE GUN, made by C. H. MALEHAM; weight, 6¼lb.; length of barrel, 30in.; make of barrel, English laminated steel; shot with 2¼drs. of Curtis's and Harvey's No. 6 powder; declared pattern, 190.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 90 | 2·09 | 43 | 202 | 12 | 102 | 79 | 2·19 | 36 | 172 | 18 | 106 |
| 102 | 2·04 | 50 | 218 | 28 | 101 | 78 | 2·23 | 35 | 144 | 41 | 99 |
| 97 | 2·07 | 47 | 201 | 11 | 100 | 115 | 2·35 | 49 | 201 | 11 | 100 |
| 28 | 3·50 | 10 | 89 | 101 | 103 | 131 | 2·38 | 55 | 208 | 18 | 96 |
| 90 | 2·20 | 41 | 164 | 26 | 100 | 106 | 2·36 | 45 | 187 | 3 | 99 |
| 94 | 2·09 | 45 | 190 | 0 | 106 | 93 | 2·45 | 38 | 192 | 2 | 97 |
| 150 | 2·24 | 67 | 218 | 28 | 99 | 145 | 2·59 | 56 | 211 | 21 | 100 |
| 48 | 2·00 | 24 | 110 | 80 | 104 | 84 | 2·33 | 36 | 180 | 10 | 96 |
| 99 | 2·11 | 47 | 191 | 1 | 99 | 117 | 2·34 | 50 | 214 | 24 | 99 |
| 96 | 2·09 | 46 | 194 | 4 | 101 | 93 | 2·16 | 43 | 216 | 26 | 100 |
| 110 | 2·08 | 53 | 219 | 29 | 101 | 140 | 2·59 | 54 | 199 | 9 | 100 |
| 137 | 2·28 | 60 | 214 | 24 | 99 | 113 | 2·35 | 48 | 219 | 29 | 97 |
| 105 | 2·19 | 48 | 196 | 6 | 108 | | | | | | |
| Total of both barrels | | | | | | | 56·60 | ... | 4749 | 567 | 2512 |
| Average of 25 shots | | | | | | | 2·2640 | ... | 189·96 | 22·68 | 100·48 |

Average force per pellet ........................ 226·40
(Average pattern, 189·96.)
Average of the deviations of patterns from declared pattern ........ 22·68
Average recoil above 80lb. ........ 20·48
Difference between highest and lowest recoils ........ 12·00
} 55·16

Figure of Merit ........................ 171·24

**16-BORE GUN**, made by W. Jones; weight, 6¼lb.; length of barrel, 28in.; make of barrel, English Damascus; shot with 3drs. of Curtis's and Harvey's No. 4 diamond powder; declared pattern, 170.

| Left Barrel. | | | | | | Right Barrel. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 100 | 2·17 | 46 | 181 | 11 | 105 | 103 | 1·98 | 52 | 211 | 41 | 104 |
| 82 | 2·28 | 36 | 181 | 11 | 108 | 62 | 2·14 | 29 | 146 | 24 | 106 |
| 100 | 2·22 | 45 | 181 | 11 | 108 | 84 | 2·10 | 40 | 167 | 3 | 105 |
| 74 | 2·24 | 33 | 176 | 6 | 108 | 80 | 2·05 | 39 | 173 | 3 | 107 |
| 80 | 2·11 | 38 | 156 | 14 | 107 | 23 | 1·92 | 12 | 72 | 98 | 108 |
| 91 | 2·33 | 39 | 189 | 19 | 109 | 105 | 2·28 | 46 | 182 | 12 | 105 |
| 67 | 2·48 | 27 | 143 | 27 | 108 | 99 | 2·06 | 48 | 157 | 13 | 105 |
| 83 | 2·31 | 36 | 157 | 13 | 108 | 66 | 2·00 | 33 | 166 | 4 | 106 |
| 101 | 2·46 | 41 | 170 | 0 | 107 | 75 | 2·21 | 39 | 154 | 16 | 107 |
| 97 | 2·21 | 44 | 165 | 5 | 108 | 54 | 2·35 | 23 | 151 | 19 | 106 |
| 88 | 2·10 | 42 | 170 | 0 | 108 | 119 | 2·21 | 54 | 183 | 13 | 105 |
| 89 | 2·17 | 41 | 180 | 10 | 108 | 80 | 1·67 | 48 | 184 | 14 | 106 |
| 55 | 2·39 | 23 | 159 | 11 | 106 | | | | | | |
| Total of both barrels | | | | | | | 54·44 | ... | 4154 | 398 | 2668 |
| Average of 25 shots | | | | | | | 2·1776 | ... | 166·16 | 15·92 | 106·72 |

| | | |
|---|---|---|
| Average force per pellet | | 217·76 |
| (Average pattern, 166·16.) | | |
| Average of the deviations of patterns from declared pattern | 15·92 | |
| Average recoil above 80lb. | 26·72 | 46·64 |
| Difference between highest and lowest recoils | 4·00 | |
| Figure of Merit | | 171·12 |

**16-BORE GUN**, made by W. R. Leeson; weight, 6lb. 1oz.; length of barrel, 30in.; make of barrel, English hardened laminated; shot with 2¾drs. of Curtis's and Harvey's coarse grain basket powder; declared pattern, 170.

| Left Barrel. | | | | | | Right Barrel. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 90 | 2·43 | 37 | 169 | 1 | 108 | 40 | 2·00 | 20 | 121 | 49 | 104 |
| 77 | 2·48 | 31 | 148 | 22 | 106 | 83 | 2·07 | 40 | 149 | 21 | 107 |
| 87 | 2·29 | 38 | 176 | 6 | 107 | 75 | 2·14 | 35 | 147 | 23 | 105 |
| 78 | 2·44 | 32 | 184 | 14 | 107 | 70 | 1·89 | 37 | 185 | 15 | 105 |
| 82 | 2·16 | 38 | 173 | 3 | 108 | 78 | 1·95 | 40 | 168 | 2 | 104 |
| 67 | 2·39 | 28 | 159 | 11 | 106 | 70 | 2·06 | 34 | 164 | 6 | 102 |
| 115 | 2·21 | 52 | 165 | 5 | 107 | 103 | 1·98 | 52 | 176 | 6 | 105 |
| 71 | 2·45 | 29 | 169 | 1 | 106 | 38 | 2·11 | 18 | 129 | 41 | 104 |
| 46 | 2·42 | 19 | 110 | 60 | 106 | 45 | 2·25 | 20 | 119 | 51 | 104 |
| 80 | 2·35 | 34 | 155 | 15 | 106 | 87 | 2·12 | 41 | 166 | 4 | 104 |
| 89 | 2·17 | 41 | 178 | 8 | 107 | 62 | 2·14 | 29 | 148 | 22 | 104 |
| 57 | 2·28 | 25 | 143 | 27 | 108 | 27 | 1·30 | 15 | 95 | 75 | 105 |
| 80 | 2·11 | 38 | 139 | 31 | 105 | | | | | | |
| Total of both barrels | | | | | | | 54·69 | ... | 3835 | 519 | 2640 |
| Average of 25 shots | | | | | | | 2·1876 | ... | 153·40 | 20·76 | 105·6 |

| | | |
|---|---|---|
| Average force per pellet | | 218·76 |
| (Average pattern, 153·49.) | | |
| Average of the deviations of patterns from declared pattern | 20·76 | |
| Average recoil above 80lb. | 25·60 | 52·36 |
| Difference between highest and lowest recoils | 6·00 | |
| Figure of Merit | | 166·40 |

**16-BORE GUN, made by Bland and Sons; weight, 6lb. 5oz.; length of barrel, 30in.; make of barrel, Belgian; shot with 2¼drs. of Curtis's and Harvey's No. 6 powder; declared pattern, 157.**

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 84 | 1·62 | 52 | 187 | 30 | 105 | 16 | 2·00 | 8 | 92 | 65 | 104 |
| 65 | 2·24 | 29 | 165 | 8 | 104 | 90 | 1·96 | 46 | 189 | 32 | 103 |
| 85 | 2·07 | 41 | 198 | 41 | 103 | 84 | 1·96 | 43 | 197 | 40 | 102 |
| 80 | 1·90 | 42 | 176 | 19 | 103 | 88 | 1·91 | 46 | 178 | 21 | 101 |
| 90 | 1·96 | 46 | 173 | 16 | 103 | 28 | 1·87 | 15 | 106 | 49 | 106 |
| 74 | 2·06 | 36 | 173 | 16 | 105 | 85 | 1·98 | 43 | 169 | 12 | 102 |
| 66 | 2·28 | 29 | 168 | 11 | 104 | 77 | 1·92 | 40 | 177 | 20 | 102 |
| 68 | 2·19 | 31 | 146 | 11 | 104 | 61 | 2·10 | 29 | 121 | 36 | 103 |
| 72 | 2·12 | 34 | 158 | 1 | 105 | 72 | 2·18 | 33 | 162 | 5 | 102 |
| 63 | 2·33 | 27 | 135 | 22 | 113 | 86 | 1·91 | 45 | 201 | 44 | 102 |
| 83 | 2·02 | 41 | 173 | 16 | 102 | 108 | 2·04 | 53 | 176 | 19 | 103 |
| 81 | 2·25 | 36 | 176 | 19 | 106 | 69 | 1·92 | 36 | 196 | 39 | 104 |
| 87 | 1·93 | 45 | 168 | 11 | 103 | | | | | | |
| Total of both barrels ................. | | | | | | | 50·72 | ... | 4162 | 603 | 2594 |
| Average of 25 shots ..................... | | | | | | | 2·0288 | ... | 166·48 | 24·12 | 103·76 |

| | | |
|---|---|---|
| Average force per pellet ........................................................ | | 202·88 |
| (Average pattern, 166·48.) | | |
| Average of the deviations of patterns from declared pattern ........................................................ | 24·12 | 59·88 |
| Average recoil above 80lb. ........................................ | 23·76 | |
| Difference between highest and lowest recoils ......... | 12·00 | |
| Figure of Merit ........................................................ | | 143·00 |

## Class III.—For 20-Bores.

**20-BORE GUN, made by E. C. Green; weight, 5lb. 13oz.; length of barrel, 30in.; make of barrel, Foreign Damascus; shot with 2drs. of Curtis's and Harvey's coarse grain basket powder, ⅞oz. shot; declared pattern, 165.**

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 84 | 2·21 | 38 | 153 | 12 | 96 | 57 | 2·19 | 26 | 133 | 32 | 94 |
| 73 | 2·28 | 32 | 154 | 11 | 95 | 66 | 2·20 | 30 | 143 | 22 | 94 |
| 59 | 2·46 | 24 | 139 | 26 | 95 | 70 | 2·26 | 31 | 158 | 7 | 95 |
| 70 | 2·26 | 31 | 157 | 8 | 96 | 44 | 2·20 | 20 | 144 | 21 | 93 |
| 62 | 2·07 | 30 | 142 | 23 | 95 | 71 | 2·09 | 34 | 143 | 22 | 96 |
| 77 | 2·26 | 34 | 150 | 15 | 98 | 95 | 2·32 | 41 | 172 | 7 | 94 |
| 63 | 2·52 | 25 | 160 | 5 | 95 | 90 | 2·25 | 40 | 157 | 8 | 96 |
| 84 | 2·15 | 39 | 141 | 24 | 95 | 58 | 2·15 | 27 | 135 | 30 | 95 |
| 73 | 2·43 | 30 | 157 | 8 | 95 | 67 | 2·03 | 33 | 155 | 10 | 96 |
| 72 | 2·25 | 32 | 150 | 15 | 93 | 73 | 2·09 | 35 | 161 | 4 | 96 |
| 79 | 2·32 | 34 | 155 | 10 | 90 | 63 | 2·25 | 28 | 148 | 17 | 95 |
| 77 | 2·33 | 33 | 142 | 23 | 98 | 75 | 2·14 | 35 | 154 | 11 | 100 |
| 65 | 2·41 | 27 | 165 | 0 | 98 | | | | | | |
| Total of both barrels ................. | | | | | | | 56·12 | ... | 3768 | 371 | 2383 |
| Average of 25 shots ..................... | | | | | | | 2·2448 | ... | 150·72 | 14·84 | 95·32 |

| | | |
|---|---|---|
| Average force per pellet ........................................................ | | 224·48 |
| (Average pattern, 150·72.) | | |
| Average of the deviations of patterns from declared pattern ........................................................ | 14·84 | 37·16 |
| Average recoil above 80lb. ........................................ | 15·32 | |
| Difference between highest and lowest recoils ......... | 7·00 | |
| Figure of Merit ........................................................ | .... | 187·32 |

**20-BORE GUN,** made by W. W. GREENER; weight, 6lb.; length of barrel, 30in.; make of barrel, English laminated: shot with 2½drs. of Pigou and Wilks's No. 3 powder; declared pattern, 168.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 48 | 2·53 | 19 | 125 | 43 | 102 | 79 | 1·93 | 41 | 174 | 6 | 103 |
| 78 | 2·29 | 34 | 162 | 6 | 101 | 95 | 2·16 | 44 | 189 | 21 | 102 |
| 64 | 2·46 | 26 | 139 | 29 | 100 | 68 | 1·94 | 35 | 119 | 49 | 100 |
| 78 | 2·23 | 35 | 166 | 2 | 100 | 83 | 2·02 | 41 | 168 | 0 | 102 |
| 85 | 2·18 | 39 | 170 | 2 | 103 | 80 | 2·00 | 40 | 188 | 20 | 101 |
| 44 | 2·32 | 19 | 93 | 75 | 101 | 78 | 2·00 | 39 | 162 | 6 | 101 |
| 57 | 2·59 | 22 | 130 | 39 | 100 | 76 | 2·05 | 37 | 174 | 6 | 102 |
| 71 | 2·22 | 32 | 148 | 20 | 102 | 48 | 2·40 | 20 | 147 | 21 | 102 |
| 64 | 2·29 | 28 | 119 | 49 | 97 | 64 | 2·29 | 28 | 155 | 13 | 101 |
| 83 | 2·02 | 41 | 148 | 20 | 101 | 66 | 2·20 | 30 | 167 | 1 | 102 |
| 58 | 2·64 | 22 | 149 | 19 | 101 | 70 | 2·12 | 33 | 158 | 10 | 103 |
| 57 | 2·48 | 23 | 155 | 13 | 102 | 77 | 2·08 | 37 | 167 | 1 | 106 |
| 48 | 2·53 | 19 | 133 | 35 | 105 | | | | | | |
| Total of both barrels | | | | | | | 55·97 | ... | 3805 | 506 | 2540 |
| Average of 25 shots | | | | | | | 2·2388 | ... | 152·20 | 20·24 | 101·60 |

Average force per pellet ........................................ 223·88
(Average pattern, 152·20.)

| | | |
|---|---|---|
| Average of the deviations of patterns from declared pattern .................... | 20·24 | |
| Average recoil above 80lb. .................... | 21·60 | 50·84 |
| Difference between highest and lowest recoils ......... | 9·00 | |

Figure of Merit ........................................ 173·04

**20-BORE-GUN,** made by W. R. LEESON; weight, 5lb. 14oz.; length of barrel, 30in.; make of barrel, English hardened laminated; shot with 2¾drs. of Curtis's and Harvey's coarse grain basket powder; declared pattern, 150.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 60 | 2·23 | 27 | 116 | 34 | 108 | 73 | 2·21 | 33 | 193 | 43 | 96 |
| 70 | 2·26 | 31 | 141 | 9 | 107 | 38 | 2·37 | 16 | 105 | 45 | 106 |
| 80 | 2·22 | 36 | 158 | 8 | 106 | 48 | 2·29 | 21 | 129 | 21 | 106 |
| 36 | 2·77 | 13 | 93 | 57 | 107 | 62 | 1·94 | 32 | 165 | 15 | 105 |
| 76 | 2·30 | 33 | 140 | 10 | 106 | 78 | 2·05 | 38 | 165 | 15 | 106 |
| 90 | 2·31 | 39 | 151 | 1 | 110 | 92 | 2·30 | 40 | 179 | 29 | 109 |
| 92 | 2·30 | 40 | 172 | 22 | 107 | 93 | 2·11 | 44 | 189 | 39 | 107 |
| 93 | 2·45 | 38 | 161 | 11 | 109 | 85 | 2·07 | 41 | 177 | 27 | 108 |
| 75 | 2·27 | 33 | 160 | 10 | 107 | 84 | 2·10 | 40 | 171 | 21 | 105 |
| 67 | 2·39 | 28 | 156 | 6 | 108 | 80 | 2·22 | 36 | 182 | 32 | 108 |
| 63 | 2·17 | 29 | 166 | 16 | 105 | 67 | 2·03 | 33 | 162 | 12 | 107 |
| 75 | 2·03 | 37 | 148 | 2 | 106 | 65 | 1·97 | 33 | 165 | 15 | 106 |
| 90 | 2·20 | 41 | 184 | 34 | 108 | | | | | | |
| Total of both barrels | | | | | | | 55·56 | ... | 3928 | 534 | 2673 |
| Average of 25 shots | | | | | | | 2·2224 | ... | 157·12 | 21·36 | 106·92 |

Average force per pellet ........................................ 222·24
(Average pattern, 110·30.)

| | | |
|---|---|---|
| Average of the deviations of patterns from average pattern .................... | 21·36 | |
| Average recoil above 80lb. .................... | 26·92 | 53·28 |
| Difference between highest and lowest recoils ......... | 5·00 | |

Figure of Merit ........................................ 168·96

20-BORE GUN, made by C. H. MALEHAM; weight, 6lb.; length of barrel, 30in.; make of barrel, English laminated steel; shot with 1¾drs. of Curtis's and Harvey's No. 6 powder; declared pattern, 170.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 87 | 1·85 | 47 | 190 | 20 | 85 | 117 | 2·29 | 51 | 210 | 40 | 86 |
| 64 | 2·06 | 31 | 162 | 8 | 89 | 85 | 1·98 | 43 | 197 | 27 | 84 |
| 85 | 1·89 | 45 | 171 | 1 | 86 | 112 | 2·12 | 53 | 197 | 27 | 88 |
| 73 | 1·97 | 37 | 190 | 20 | 88 | 89 | 2·17 | 41 | 192 | 22 | 88 |
| 112 | 2·00 | 56 | 208 | 38 | 88 | 97 | 2·16 | 45 | 202 | 32 | 91 |
| 66 | 2·06 | 32 | 143 | 27 | 90 | 80 | 2·05 | 39 | 195 | 25 | 86 |
| 91 | 2·07 | 44 | 190 | 20 | 93 | 100 | 1·96 | 51 | 206 | 36 | 88 |
| 96 | 1·92 | 50 | 168 | 2 | 88 | 133 | 2·25 | 59 | 205 | 35 | 89 |
| 98 | 2·00 | 49 | 182 | 12 | 92 | 58 | 2·07 | 28 | 114 | 56 | 91 |
| 85 | 1·89 | 45 | 184 | 14 | 92 | 80 | 2·16 | 37 | 192 | 22 | 90 |
| 81 | 2·02 | 40 | 176 | 6 | 90 | 55 | 2·29 | 24 | 170 | — | 90 |
| 85 | 1·98 | 43 | 193 | 23 | 91 | 111 | 2·14 | 52 | 182 | 12 | 90 |
| 79 | 1·88 | 42 | 176 | 6 | 89 | | | | | | |
| | Total of both barrels | | | | | | 51·23 | ... | 4595 | 531 | 2222 |
| | Average of 25 shots | | | | | | 2·0492 | ... | 183·80 | 21·24 | 88·88 |

| | | |
|---|---|---|
| Average force per pellet | | 204·92 |
| (Average pattern, 183·80.) | | |
| Average of the deviations of patterns from declared pattern | 21·24 | 39·12 |
| Average recoil above 80lb. | 8·88 | |
| Difference between highest and lowest recoils | 9·00 | |
| Figure of Merit | | 165·80 |

20-BORE GUN, made by W. JONES; weight, 5lb. 13oz.; length of barrel, 28in.; make of barrel, English Damascus; shot with 2¼drs. of Curtis's and Harvey's No. 3 powder; declared pattern, 174.

| LEFT BARREL. | | | | | | RIGHT BARREL. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Penetration. | | Pattern. | | | | Penetration. | | Pattern. | | | |
| On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. | On Gauge. | Per Pellet. | 10in. | Tot. | Diff. | Recoil. |
| 84 | 2·15 | 39 | 151 | 23 | 105 | 66 | 2·13 | 31 | 168 | 6 | 104 |
| 77 | 2·14 | 36 | 175 | 1 | 105 | 73 | 2·03 | 36 | 172 | 2 | 102 |
| 59 | 2·19 | 27 | 154 | 20 | 105 | 41 | 2·28 | 18 | 121 | 53 | 103 |
| 93 | 2·11 | 44 | 185 | 11 | 100 | 89 | 2·22 | 40 | 168 | 6 | 103 |
| 72 | 2·25 | 32 | 122 | 52 | 103 | 66 | 1·94 | 34 | 160 | 14 | 105 |
| 92 | 2·42 | 38 | 153 | 21 | 106 | 74 | 2·18 | 34 | 169 | 5 | 103 |
| 109 | 2·14 | 51 | 178 | 4 | 105 | 83 | 2·13 | 39 | 172 | 2 | 104 |
| 134 | 2·35 | 57 | 194 | 20 | 105 | 61 | 2·26 | 27 | 160 | 14 | 107 |
| 50 | 2·38 | 21 | 145 | 29 | 100 | 75 | 2·14 | 35 | 172 | 2 | 103 |
| 72 | 2·18 | 33 | 154 | 20 | 104 | 72 | 2·32 | 31 | 176 | 2 | 103 |
| 74 | 1·95 | 38 | 170 | 4 | 103 | 15 | 1·50 | 10 | 86 | 88 | 104 |
| 58 | 2·32 | 25 | 130 | 44 | 105 | 64 | 2·29 | 23 | 185 | 11 | 104 |
| 100 | 2·00 | 50 | 180 | 6 | 106 | | | | | | |
| | Total of both barrels | | | | | | 54·00 | ... | 4000 | 460 | 2612 |
| | Average of 25 shots | | | | | | 21·600 | ... | 160·00 | 18·40 | 10·448 |

| | | |
|---|---|---|
| Average force per pellet | | 216·00 |
| (Average pattern, 160·00) | | |
| Average of the deviations of patterns from declared pattern | 18·40 | 52·88 |
| Average recoil above 80lb. | 24·48 | |
| Difference between highest and lowest recoils | 10·00 | |
| Figure of Merit | | 163·12 |

20-BORE GUN, made by W. H. TISDALL; weight, 6lb.; length of barrel, 29in.; make of barrel, English laminated; shot with 2¼drs. of Curtis's and Harvey's No. 4 powder; declared pattern, 155.

| LEFT BARREL. Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. | RIGHT BARREL. Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71 | 2·29 | 31 | 130 | 25 | 104 | 58 | 2·00 | 29 | 134 | 21 | 105 |
| 75 | 1·92 | 39 | 153 | 2 | 105 | 75 | 1·97 | 38 | 177 | 22 | 102 |
| 83 | 1·89 | 44 | 179 | 24 | 102 | 83 | 1·98 | 42 | 159 | 4 | 110 |
| 88 | 2·00 | 44 | 155 | 0 | 104 | 59 | 1·90 | 31 | 143 | 12 | 102 |
| 65 | 2·41 | 27 | 164 | 9 | 105 | 68 | 2·27 | 30 | 159 | 4 | 103 |
| 105 | 2·10 | 50 | 175 | 20 | 103 | 50 | 2·17 | 23 | 136 | 19 | 104 |
| 76 | 2·05 | 37 | 147 | 8 | 100 | 76 | 1·81 | 42 | 163 | 8 | 102 |
| 58 | 1·87 | 31 | 132 | 23 | 101 | 80 | 2·11 | 38 | 164 | 9 | 102 |
| 70 | 2·19 | 32 | 199 | 44 | 102 | 84 | 2·00 | 42 | 162 | 7 | 102 |
| 90 | 2·05 | 44 | 174 | 19 | 103 | 87 | 1·98 | 44 | 145 | 10 | 101 |
| 57 | 2·37 | 24 | 168 | 13 | 106 | 52 | 1·88 | 33 | 162 | 7 | 103 |
| 53 | 2·41 | 28 | 123 | 32 | 102 | 64 | 1·88 | 34 | 157 | 2 | 102 |
| 86 | 2·15 | 40 | 168 | 13 | 102 | | | | | | |
| Total of both barrels | | | | | | | 51·65 | ... | 3928 | 357 | 2577 |
| Average of 20 shots | | | | | | | 2·060 | ... | 157·12 | 14·28 | 103·08 |

| | | |
|---|---|---|
| Average force per pellet | | 206·60 |
| (Average pattern, 157·12.) | | |
| Average of the deviations of patterns from declared pattern | 14·28 | 47·36 |
| Average recoil above 80lb. | 23·08 | |
| Difference between highest and lowest recoils | 10·00 | |
| Figure of Merit | | 159·24 |

It was, as already remarked, clearly demonstrated in this trial that a sufficiently regular pattern can always be obtained; and therefore no reason can be adduced why, in trying guns of different classes, we should not in future return to the original figure of merit adopted in 1866, and composed of the pattern added to the penetration, only taking care that the latter should bear a due proportion to the former. In the 1866 and 1875 trials this was effected by multiplying the sheets of paper broken by 6, but under the force gauge it will be necessary to multiply by 100, and on this plan the following would be the respective figures of merit of the three gauges tried in 1879, taking the averages of the six best guns in each as recorded above.

In the 1879 trials the deductions for recoil were far too great for a fair comparison between the three classes, though fair enough in each class by itself. The only reason for

admitting recoil at all as a test is that, when excessive, it causes a disagreeable shock to the shoulder; but we know from experience that 3drs. of powder in a 20-bore will cause much more annoyance than 3¼drs. in a 12-bore, yet it will measure much less as "recoil" in the machine. It is evident, from an examination of the above tables, that by using smaller charges of powder Mr. Green succeeded in reducing his recoil in the 16 and 20-bores below that of the winning 12-bore from 31·24 to 19·24 and 15·32 respectively, the total deductions of the winning guns in the three classes being as follows:

| | Variation in pattern. | Recoil above 80lb. | Variation in recoil. | |
|---|---|---|---|---|
| Class 1 (12-bores) | 21·32 | 31·24 | 6 | = 58·56 |
| Class 2 (16-bores) | 15·36 | 19·24 | 5 | = 39·60 |
| Class 3 (20-bores) | 14·84 | 15·32 | 7 | = 37·16 |

Mr. Greener's 12-bore gun (the winner in Class 1) is thus shown to have been penalised 18·96 in favour of the winning 16-bore, and 21·40 in favour of the winning 20-bore, irrespective of the comparative variation in pattern, which was also in great measure due to the reduction in the charge of powder.

Having thus shown the impropriety of importing the above deductions into the comparison, I now proceed to make it altogether without them.

TABLE SHOWING THE FIGURE OF MERIT OF THE 1879 GUNS ON THE PLAN ADOPTED IN 1878.

Class 1.—12-bores shot with 1⅛oz. No. 6 chilled shot; penetration tested with force gauge, and all shot from machine rest.

| | Pattern. | Penetration. | Fig. of Merit. |
|---|---|---|---|
| Mr. Jeffries | 209·60 | 238·72 | 448·32 |
| Mr. Maleham | 224·48 | 222·00 | 446·48 |
| Messrs. Trulock and Harris | 211·80 | 224·52 | 436·32 |
| Mr. Greener | 204·20 | 231·20 | 435·40 |
| Mr. Rosson | 206·84 | 223·12 | 429·96 |
| Mr. Leeson | 174·00 | 225·32 | 399·32 |
| Average | 205·15 | 227·48 | 432·63 |

Class 2.—16-bores shot with 1oz. chilled shot, No. 6, except Mr. Green's, shot with ⅞oz.; conditions as before.

| | Pattern. | | Penetration. | | Fig. of Merit. |
|---|---|---|---|---|---|
| Mr. Maleham ..................... | 189·96 | ...... | 226·40 | ...... | 416·36 |
| Mr. Jeffries ..................... | 174·00 | ...... | 222·80 | ...... | 396·80 |
| Mr. Green ..................... | 170·36 | ...... | 224·44 | ...... | 394·80 |
| Mr. Jones ..................... | 166·16 | ...... | 217·76 | ...... | 383·92 |
| Mr. Leeson ..................... | 153·40 | ...... | 218·76 | ...... | 372·16 |
| Messrs. Bland ..................... | 166·48 | ...... | 202·88 | ...... | 369·36 |
| Average .. ......... | 170·06 | ...... | 218·84 | ...... | 388·90 |

Class 3.—20-bores shot with ⅞oz. of chilled shot.

| | Pattern. | | Penetration. | | Fig. of Merit. |
|---|---|---|---|---|---|
| Mr. Maleham ..................... | 183·80 | ...... | 204·92 | ...... | 388·72 |
| Mr. Leeson ..................... | 157·12 | ...... | 222·24 | ...... | 379·36 |
| Mr. Greener ..................... | 152·20 | ...... | 223·88 | ...... | 376·08 |
| Mr. Jones ..................... | 160·00 | ...... | 216·00 | ...... | 376·00 |
| Mr. Green ..................... | 150·72 | ...... | 224·48 | ...... | 375·20 |
| Mr. Tisdale ..................... | 157·12 | ...... | 206·60 | ...... | 363·72 |
| Average ........... | 160·16 | ...... | 216·35 | ...... | 376·51 |

GENERAL SUMMARY.

| | Average Pattern. | | Average Penetration. | | Figure of Merit. |
|---|---|---|---|---|---|
| 12-bores | 205·15 | + | 227·48 | = | 432·63 |
| 16 „ | 170·06 | + | 218·84 | = | 388·90 |
| 20 „ | 160·16 | + | 216·35 | = | 376·51 |

On this calculation, instead of the smaller bores beating the 12-bore, as appeared from the result of the trial under the arranged conditions, the 12-bore comes out by far the best, beating the 16-bore by 43·73, and the 20-bore by 56·12. And the difference in the charge does not suffice altogether to account for the difference of result; for, excepting Mr. Green's, the 16-bore had about 11 per cent. fewer pellets than the 12-bore, but the pattern was about 17 per cent. less. With the 20-bore, however, the charge is about 22 per cent. less than that of the 12-bore, and the pattern also about 22 per cent. less. As regards penetration, the 16-bore scored about 4 per cent. and the 20-bore about 5 per cent. less than the 12-bore.

The penetration effected by a shot gun can also be obtained by ascertaining the velocity of its shot with the chronograph, which is used for testing the velocity of rifle balls; but the machine is very expensive, and hitherto it has only been applied to this purpose as a basis for theoretical calculation. I shall therefore postpone its consideration till I come to treat of ammunition.

With regard to the pattern and penetration effected by guns with larger shot, the following trials are recorded in the *Field* as having been made by me in 1879. The figure of merit, it will be seen, was calculated on the same basis as that used in the trials with No. 6 shot which had just taken place (May, 1879), and of which the results are given in pages 58 to 67. A figure of merit on the 1878 basis is given overleaf (pages 72-3).

Trial of 12 and 20-bore by the same maker, with chilled shot Nos. 6, 5, and 4; 10 shots in each case, with the same barrel.

**12-BORE GUN, weight 7¼lb.; English laminated barrels, 30in. long; shot with 3drs. C. and H. No. 6, and 1⅛oz. No. 6 Newcastle Company chilled shot; recoil spring screwed to 60.**

| Penetration. On Gauge. | Penetration. Per Pellet. | Pattern. 10in. | Pattern. Tot. | Pattern. Diff. | Recoil. | Penetration. On Gauge. | Penetration. Per Pellet. | Pattern. 10in. | Pattern. Tot. | Pattern. Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 2·37 | 38 | 196 | 1 | 104 | 127 | 2·35 | 54 | 221 | 24 | 105 |
| 77 | 2·48 | 31 | 188 | 9 | 106 | 149 | 2·53 | 59 | 228 | 31 | 108 |
| 186 | 2·45 | 76 | 218 | 21 | 105 | 107 | 2·23 | 48 | 190 | 7 | 105 |
| 98 | 2·33 | 42 | 197 | 0 | 105 | 80 | 1·95 | 41 | 164 | 33 | 105 |
| 130 | 2·36 | 55 | 224 | 27 | 109 | | | | | | |
| 70 | 2·33 | 30 | 149 | 48 | 108 | Av. | 2·338 | | 197·5 | 20·1 | 106·0 |

Average force per pellet ........................................ 233·80
(Average pattern, 197·50.)
Average of the deviation of patterns from average pattern ........................................ 20·10
Average recoil above 80lb. ........................................ 26·00
Difference in recoil ........................................ 5·00
(together) 51·10

Figure of Merit ........................................ 182·70

**SAME GUN; shot with same powder, but 1⅛oz. No. 5 Newcastle shot.**

| Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. | Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 96 | 2·82 | 34 | 182 | 27 | 102 | 68 | 2·72 | 25 | 141 | 14 | 105 |
| 74 | 2·64 | 28 | 175 | 20 | 104 | 70 | 2·69 | 26 | 138 | 17 | 105 |
| 78 | 2·69 | 29 | 174 | 19 | 105 | 48 | 2·40 | 20 | 96 | 59 | 103 |
| 76 | 2·53 | 30 | 173 | 18 | 107 | 64 | 2·46 | 26 | 110 | 45 | 106 |
| 84 | 2·90 | 29 | 190 | 35 | 103 | | | | | | |
| 90 | 3·00 | 30 | 172 | 17 | 105 | Av. | 2·685 | | 155·1 | 27·1 | 104·5 |

Average force per pellet ........................................ 268·50
(Average pattern, 155·10.)
Average of the deviation of patterns from average pattern ........................................ 27·10
Average recoil above 80lb. ........................................ 24·50
Difference in recoil ........................................ 5·00
(together) 56·60

Figure of Merit ........................................ 211·90

**SAME GUN; shot with 1⅛oz. No. 4 Newcastle chilled shot.**

| Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. | Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | 3·12 | 17 | 88 | 10 | 101 | 64 | 2·91 | 22 | 100 | 2 | 104 |
| 43 | 2·87 | 15 | 96 | 2 | 102 | 75 | 3·12 | 24 | 105 | 7 | 101 |
| 72 | 2·57 | 28 | 104 | 6 | 103 | 84 | 3·11 | 27 | 110 | 12 | 103 |
| 61 | 3·05 | 20 | 101 | 3 | 101 | 61 | 3·21 | 19 | 93 | 5 | 101 |
| 78 | 3·12 | 25 | 97 | 1 | 105 | | | | | | |
| 64 | 3·33 | 18 | 89 | 9 | 106 | Av. | 3·041 | | 98·3 | 5·7 | 102·7 |

Average force per pellet ........................................ 304·10
(Average pattern, 98·30.)
Average of the deviation of patterns from average pattern ........................................ 5·70
Average recoil above 80lb. ........................................ 22·70
Difference in recoil ........................................ 5·00
(together) 33·40

Figure of Merit ........................................ 270·70

**20-BORE GUN, weight, 5lb. 14oz.; English laminated iron 30in. barrel; shot with 2¼drs. Curtis's and Harvey's No. 4 powder, ⅞oz. No. 6 Newcastle chilled shot.**

| Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. | Penetration. On Gauge. | Per Pellet. | Pattern. 10in. | Tot. | Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 84 | 2·21 | 38 | 150 | 4 | 98 | 57 | 2·48 | 23 | 158 | 12 | 96 |
| 62 | 2·07 | 30 | 145 | 1 | 96 | 90 | 2·20 | 41 | 180 | 34 | 98 |
| 72 | 2·25 | 32 | 148 | 2 | 99 | 79 | 2·32 | 34 | 154 | 8 | 99 |
| 44 | 2·32 | 19 | 104 | 42 | 100 | 73 | 2·28 | 32 | 151 | 5 | 92 |
| 64 | 2·46 | 26 | 141 | 5 | 95 | | | | | | |
| 48 | 2·53 | 19 | 131 | 15 | 94 | Av. | 2·312 | | 146·2 | 12·8 | 96·7 |

Average force per pellet ........................................ 231·20
(Average pattern, 146·20.)
Average of the deviation of patterns from average pattern ........................................ 12·80
Average recoil above 80lb. ........................................ 16·70
Difference in recoil ........................................ 8·00
(together) 37·50

Figure of Merit ........................................ 193·70

SAME GUN; shot with ⅞oz. No. 5 Newcastle chilled shot.

| Penetration. On Gauge. | Penetration. Per Pellet. | Pattern. 10in. | Pattern. Tot. | Pattern. Diff. | Recoil. | Penetration. On Gauge. | Penetration. Per Pellet. | Pattern. 10in. | Pattern. Tot. | Pattern. Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 58 | 2·76 | 21 | 106 | 28 | 95 | 50 | 2·94 | 17 | 88 | 0 | 97 |
| 59 | 2·57 | 23 | 118 | 30 | 94 | 50 | 2·78 | 18 | 66 | 22 | 96 |
| 68 | 2·43 | 28 | 130 | 42 | 96 | 40 | 2·86 | 14 | 43 | 45 | 91 |
| 70 | 2·80 | 25 | 119 | 31 | 96 | 38 | 2·37 | 16 | 38 | 50 | 92 |
| 59 | 3·11 | 19 | 73 | 15 | 95 | | | | | | |
| 88 | 2·93 | 30 | 98 | 10 | 93 | Av. | 2·755 | | 87·9 | 27·3 | 94·5 |

Average force per pellet .......................................... 275·50
(Average pattern, 87·90.)
Average of the deviation of patterns from average
pattern ................................................ 27·30
Average recoil above 80lb. ............................ 14·50
Difference in recoil .................................... 6·00 } 47·80

Figure of Merit .......................................... 227·70

SAME GUN; shot with ⅞oz. No. 4 Newcastle chilled shot.

| Penetration. On Gauge. | Penetration. Per Pellet. | Pattern. 10in. | Pattern. Tot. | Pattern. Diff. | Recoil. | Penetration. On Gauge. | Penetration. Per Pellet. | Pattern. 10in. | Pattern. Tot. | Pattern. Diff. | Recoil. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | 3·19 | 16 | 110 | 32 | 97 | 41 | 3·15 | 13 | 50 | 28 | 91 |
| 56 | 2·95 | 19 | 125 | 47 | 95 | 47 | 2·76 | 17 | 84 | 6 | 95 |
| 48 | 3·20 | 15 | 84 | 6 | 96 | 48 | 3·00 | 16 | 62 | 16 | 96 |
| 64 | 3·37 | 19 | 90 | 12 | 94 | 28 | 3·11 | 9 | 38 | 40 | 92 |
| 68 | 3·23 | 21 | 93 | 15 | 93 | | | | | | |
| 39 | 3·24 | 12 | 49 | 29 | 92 | Av. | 3·120 | | 78·5 | 23·1 | 94·1 |

Average force per pellet .......................................... 312·00
(Average pattern, 78·50.)
Average of the deviation of patterns from average
pattern ................................................ 23·10
Average recoil above 80lb. ............................ 14·10
Difference in recoil .................................... 5·00 } 42·20

Figure of Merit .......................................... 269·80

On comparing these tables according to the 1878 figure of merit, the following results come out, some of which are a little remarkable.

| 12-BORE. | | 20-BORE. | |
|---|---|---|---|
| 1⅛oz. No. 6 shot. | | ⅞oz. No. 6 shot. | |
| Pattern ........... | 197·50 | Pattern ........... | 146·20 |
| Average Force ... | 233·80 | Average Force ... | 231·20 |
| Fig. of Merit ... | 431·30 | Fig. of Merit ... | 377·40 |

| 12-BORE. | | 20-BORE. | |
|---|---|---|---|
| 1⅛oz. No. 5 shot. | | ⅞oz. No. 5 shot. | |
| Pattern ........... | 155·10 | Pattern ........... | 87·90 |
| Average Force ... | 268·50 | Average Force ... | 275·50 |
| Fig. of Merit ... | 423·60 | Fig. of Merit ... | 363·40 |
| 1⅛oz. No. 4 shot. | | ⅞oz. No. 4 shot. | |
| Pattern ........... | 98·30 | Pattern ........... | 78·50 |
| Average Force ... | 304·10 | Average Force ... | 312·00 |
| Fig. of Merit ... | 402·40 | Fig. of Merit ... | 390·50 |

The general supposition previously held that larger shot would tell in favour of the force of the 12-bore was not realised, as No. 6 gives a slight superiority in force to the latter, while with No. 5 and No. 4 the 20-bore is considerably the higher; but in regularity of pattern the 12-bore had the advantage. The deviations in pattern of the 20-bore were much greater with Nos. 4 and 5 than with No. 6, being on the average more than double, while with the 12-bore they were only slightly increased. In each case the recoil diminished from the small to the large size of shot. The wadding used was in accordance with my usual principle, viz., a pink-edged wad over the powder, then an ordinary felt three-eighths of an inch thick, on which was a thin cardboard wad, and another of the same kind over the shot: Eley's green cases, all turned down in the usual way. Both the powder and shot were carefully weighed.

In reference to this trial the following very interesting letter appeared shortly afterwards in the *Field* from a correspondent who has thrown considerable light on it and kindred subjects in its columns:

Sir,—Your trials of No. 4 and 5 shot, in comparison with No. 6, so far as you have yet been able to carry them out, appear to have

been productive of rather unexpected results—unexpected, at all events, to myself, and possibly to others; for, making due allowance on all sides for the difference in number and weight of the pellets, the large sizes fall short in penetration as well as pattern when compared with No. 6.

This may not be apparent at the first glance; but by analysing the tables of results it will be found that the *proportion* of the charge which struck the target was less with No. 5 than with No. 6, and still less with No. 4 than with No. 5; likewise that the blow given by those pellets which did hit the target diminished in force (in proportion to weight) as the shot increased in size.

In the latter respect—the force per pellet—the result is quite opposite to what may be expected, because the larger the pellet, the less surface in proportion to weight does it offer to the resistance of the atmosphere, and the less speed does it lose in consequence; so that it might naturally be supposed it would hit harder at 40 yards, over and above the mere difference in weight.

As the "average force per pellet" has so considerable an effect in enhancing the "figure of merit" constructed for the May trials (1879), an opinion very different from that at which I have arrived may easily be formed after a cursory glance at the tables now published. But the trial of May does not stand on all fours with that of different-sized shot. In the former, "pattern" *per se* was omitted, for the reason that different men hold different opinions as to the number of pellets that should be put within a 30-inch circle, and as each can get his wishes carried out to order, pattern may be looked on as a fixed quantity and passed over, the contest being confined to penetration, regularity of shooting, recoil, &c. It is otherwise, however, in comparing the shooting with different-sized pellets from the same gun. There the gun is the fixed quantity, with the pattern of which (as used with No. 6 shot) it may be supposed that the owner is content. The object of the inquiry is to ascertain whether other sizes of shot give equally good results; and for such a purpose pattern must be taken into consideration, otherwise a gun which puts, say, two-thirds of an ounce of shot on the target in the one case might fail to put one-third on it in the other, and yet show a better result merely on "force per pellet." For these reasons I beg leave to set forth the grounds upon which I have ventured to make the assertions with which I commenced this letter.

No. 6 shot has 270 pellets to the ounce, and No. 5 has but 218 or thereabouts (as I find different samples vary a pellet or two); and not having any No. 4 at hand, I take the number stated in "British Rural Sports," viz., 177.* Hence, with charges of equal weight, the pellets of No. 6 are very nearly one-fourth more numerous than those of No. 5, while a single pellet of No. 5 is one-fourth heavier than a pellet of No. 6. Accordingly, if a gun shoots equally well with the different sizes of shot, its "pattern" with No. 6 will contain one-fourth more pellets than with No. 5, and the "force per pellet" of No. 5 will be one-fourth greater than with No. 6. In like manner with No. 4, the pellets to the ounce (177) are about two-thirds those of No. 6, so that the pattern of the former should be as two to three of the latter, and the force per pellet as three to two.

On this basis, taking as a standard the average of the shots with the guns used last week, I give what would be the corresponding results of an equal portion of the charge of the larger sizes of shot, supposing that the pellets struck the target with equal velocity; and I place alongside the actual results as taken from last week's tables:

12-BORE GUN.

| | Proportionate Numbers. | | | | Actual Results. | | | |
|---|---|---|---|---|---|---|---|---|
| | Pattern. | | Force per Pellet. | | Pattern. | | Force per Pellet. | |
| No. 6 | 197·50 | × | 2·338 | = 461·75 | 197·50 | × | 2·338 | = 461·75 |
| No. 5 | 159·45 | × | 2·896 | = 461·75 | 155·10 | × | 2·685 | = 416·44 |
| No. 4 | 129·49 | × | 3·566 | = 461·75 | 98·30 | × | 3·041 | = 298·93 |

20-BORE GUN.

| | Proportionate Numbers. | | | | Actual Results. | | | |
|---|---|---|---|---|---|---|---|---|
| | Pattern. | | Force per Pellet. | | Pattern. | | Force per Pellet. | |
| No. 6 | 146·20 | × | 2·312 | = 338·00 | 146·20 | × | 2·312 | = 338·00 |
| No. 5 | 118·02 | × | 2·864 | = 338·00 | 87·90 | × | 2·755 | = 242·16 |
| No. 4 | 95·83 | × | 3·527 | = 338·00 | 78·50 | × | 3·120 | = 244·92 |

Of course, one can hardly draw a general conclusion from so small an amount of data, but, so far as these trials have gone,

* If the shot used at the trial does not quite agree with this number the difference will not be material, as if the pellets are more numerous, there must be a corresponding decrease in weight, and *vice versâ*.

they lead to the inference that the larger the pellets the sooner they spread after leaving the muzzle of the gun; and that therefore they encounter the full resistance of the atmosphere for a greater distance than the smaller pellets, which keep together longer in a ball, so to speak.

The difference of effect between travelling in a compact mass and travelling separately can only be very roughly estimated. To give an approximate idea, however, I will treat the mass as it were a solid ball; but as a 12-bore bullet would weigh more than the shot, and this additional weight would give a further advantage to the ball, I shall, in making the following calculations, suppose the metal to be lighter and the weight to be only $1\frac{1}{8}$oz.

In Professor Bashforth's "Mathematical Treatise on the Motion of Projectiles"—the most reliable book, I believe, ever published on this subject—very elaborate tables are given for calculating the retardation of elongated and spherical projectiles, the weight and diameter of which are known; and, although these were of course intended for military weapons, the same laws will apply to a certain extent to shot guns—*i.e.*, so far as the pellets can be looked on as travelling independently.

Taking the weight of a No. 6 pellet at $\frac{1}{270}$oz. and its diameter at $\frac{1}{10}$in.,* a pellet starting with 1200ft. velocity would, according to calculations based on Professor Bashforth's tables,† have the following velocities at intervals of 10ft. up to 40 yards, while a

---

* Having measured two samples of No. 6 shot, by different makers, I found that 99 pellets of the one and 100 of the other almost exactly equalled 10in.; and of No. 5 shot, 89 pellets of one sample measured 10in., and 90 pellets of another were rather under that measurement; besides which, the larger pellets were the lightest, numbering one or two more to the ounce.

† I cannot attempt to give here any account of Professor Bashforth's process of calculating the velocity of projectiles beyond stating that it is based on the fact (ascertained by experiment) that within certain limits the retardation from resistance of the atmosphere varies as the cube of the velocity of the projectile; that at very high velocities (not likely to affect shot guns) the ratio diminishes; and that at low velocities the ratio is higher than the cube. This necessitates a variable coefficient, provided for in Professor Bashforth's tables. The amount of resistance varies likewise with the form, diameter, and weight of the projectiles—the resistance to an elongated projectile with ogival head being represented, at 1140ft. velocity, by the number 1042; with a hemispherical head 1329; and with a flat head 1396; while with a spherical shot it is 1534.

12-bore ball of $1\frac{1}{8}$oz. weight would lose velocity with much less rapidity, as shown by the figures placed alongside:

| Single Pellet of No. 6. | | $1\frac{1}{8}$oz. Ball of 12-Bore. | |
|---|---|---|---|
| Initial velocity | 1200 | Initial velocity | 1200 |
| At 10 feet | 1112 | At 10 feet | 1185 |
| „ 20 „ | 1038 | „ 20 „ | 1169 |
| „ 30 „ | 975 | „ 30 „ | 1154 |
| „ 40 „ | 922 | „ 40 „ | 1140 |
| „ 50 „ | 874 | „ 50 „ | 1126 |
| „ 60 „ | 830 | „ 60 „ | 1112 |
| „ 70 „ | 791 | „ 70 „ | 1099 |
| „ 80 „ | 755 | „ 80 „ | 1086 |
| „ 90 „ | 723 | „ 90 „ | 1073 |
| „ 100 „ | 693 | „ 100 „ | 1061 |
| „ 110 „ | 665 | „ 110 „ | 1050 |
| „ 120 „ | 640 | „ 120 „ | 1039 |

With a No. 5 pellet, having the same initial velocity as above, the striking velocity at 40 yards would be about 15 feet higher than the No. 6.

If, then, we suppose, through irregular loading, a defective wad, or an excessive charge of powder, the mass of shot begins to break up immediately on leaving the muzzle of the gun, the pellets which first separate will lose speed as compared with those which keep together, and the shot will reach the target in comparatively straggling order, and their velocity at the moment of impact will be low on the average; whereas if the mass keep together for a good distance, their average velocity will be comparatively high. At the end of six or seven yards, pellets which quitted the mass immediately on leaving the gun would probably have lost about a hundred feet velocity as compared with those which keep together; and if these slow pellets subsequently hit the force gauge, they can only serve to reduce "the average force per pellet." Mr. B. C. Evelegh, who officiated at the gun trial of May, 1879, and who was stationed immediately behind the target in order to make the records of the force gauge, informed me that his ear eventually became so educated to the difference of sounds produced by the pellets reaching the target, that before looking at the index he could form a very fairly approximate notion of the force which would be registered on the gauge, according as the pellets produced a sudden blow or a more or less irregular clatter on striking the target.

The gun which showed the greatest penetration in the May trials gave 2·3872 as the average force per pellet, and this multiplied by 270 (as explained in my letter of May 10, 1879), gives 645ft. as the

final or striking velocity at 40 yards. This would correspond with an initial velocity of 1223ft., as based on Professor Bashforth's tables. The gun used last week gave nearly as good penetration as the highest at the May trial—the average force per pellet being 2·338 with No. 6, which would give 631ft. as the final velocity at 40 yards, and this would correspond with an initial velocity of 1166ft. The general average of the 12-bores at the May trials was equal to 592ft. final velocity at 40 yards, which corresponds with 1015 initial velocity. And the 12-bore giving the lowest penetration at the May trial showed an average force per pellet of 2·0068, or 542 final velocity at 40 yards, which corresponds with an initial velocity of only 886ft. Now it is impossible to suppose that these guns could differ to such an extent as regards the force with which they discharged their pellets. In all probability the initial velocity varied comparatively little with equal charges; but the final velocity depended on the manner in which the pellets kept together.

In Cape's "Mathematics," a work published some thirty or forty years ago for the use of the military students of Addiscombe, a formula founded on actual experiment is given for calculating the approximate initial velocity of ball from smooth-bored guns; viz.: Multiply by 3 the weight of the powder, divide by the weight of the shot; extract the square root of the quotient, multiply that root by 1600, and the product will be the initial velocity in feet. If we apply this to 3dr. of powder and a 1oz. ball, we find that three times 3dr. divided by 16dr. is equal to $\frac{9}{16}$, the square root of which is $\frac{3}{4}$; this, multiplied by 1600, gives 1200ft. as the initial velocity. If the same process be carried out with $3\frac{1}{4}$dr. and $1\frac{1}{8}$ oz. ball the result will be an initial velocity of rather under 1160ft. With loose shot the initial velocity would doubtless be somewhat less, owing to the greater amount of friction in the barrel arising from the numerous points of contact, the friction being in inverse proportion to the size of the pellets. I therefore conclude that 1100 or 1150 would be somewhere about the initial velocity of the pellets, and that according as they travel more or less compactly, so does their striking velocity vary at any given distance.

I hope that further experiments may be carried out with the different sizes of shot; and I think it probable that the larger kinds will show better results with reduced charges of powder, as the pellets will be less likely to scatter on leaving the muzzle of the gun. T.

In 1878, after the expiration of the regular trials, some of the guns were tried at 50 and 60 yards, with No. 6 and No 5 shot, but the pads being composed of too small a number of sheets, no very satisfactory results were obtained. I append the scores, however, for what they are worth.

### SHOOTING AT 50 YARDS, WITH 1¼OZ. NO. 6 SHOT.

CHOKE-BORE GUN, MADE BY W. W. GREENER; WT. 7lb. 3oz.; SHOT WITH

#### 3½dr. PIGOU AND WILKS, No. 4.

| LEFT BARREL. Penet. | Pat. | Recoil. | | RIGHT BARREL. Penet. | Pat. | Recoil. |
|---|---|---|---|---|---|---|
| thro. | 182 | 86 | ... | thro. | 156 | 84 |
| ,, | 128 | 84 | ... | ,, | 146 | 83 |
| ,, | 142 | 92 | ... | ,, | 157 | 84 |
| ,, | 171 | 84 | ... | ,, | 157 | 84 |
| ,, | 147 | 85 | ... | ,, | 156 | 85 |
| ,, | 132 | 85 | ... | ,, | 155 | 84 |
| ,, | 158 | 84 | ... | ,, | 155 | 86 |
| ,, | 148 | 83½ | ... | ,, | 175 | 84½ |
| ,, | 157 | 85 | ... | ,, | 165 | 84½ |
| ,, | 156 | 84½ | ... | ,, | 149 | 84 |
| 17 | 122 | 85 | ... | ,, | 192 | 86 |
| thro. | 131 | 85½ | ... | ,, | 147 | 83½ |
| ,, | 161 | 84 | | | | |

Average penetration × 6 ......... 119·28
Average pattern ......... 153·80
Difference in pattern ... 31·80 }
Aver. recoil above 50lb. 34·80 } 75·60
Difference in recoil...... 9·00 }

Figure of Merit.............. 43·68

The pads in this round consisted of 20 sheets, and, except in one instance, all the sheets were penetrated.

#### 3½dr. CURTIS, No. 4.

| LEFT BARREL. Penet. | Pat. | Recoil. | | RIGHT BARREL. Penet. | Pat. | Recoil. |
|---|---|---|---|---|---|---|
| 15 | 160 | 87 | ... | 13 | 141 | 86 |
| 13 | 139 | 86 | ... | 15 | 135 | 86½ |
| 13 | 108 | 87½ | ... | 13 | 100 | 87 |
| 15 | 140 | 88 | ... | 15 | 133 | 86 |
| 13 | 132 | 88 | ... | 15 | 114 | 90 |
| 17 | 148 | 88 | ... | 13 | 125 | 89 |
| 15 | 148 | 90 | ... | 13 | 154 | 88 |
| 15 | 158 | 87 | ... | 14 | 136 | 88 |
| 12 | 138 | 89½ | ... | 14 | 104 | 88 |
| 14 | 141 | 85 | ... | 14 | 101 | 87 |
| 13 | 127 | 90½ | ... | 14 | 144 | 90 |
| 14 | 114 | 88 | ... | 16 | 143 | 86 |
| 14 | 107 | 87 | | | | |

Average penetration × 6 ......... 84·48
Average pattern ......... 131·60
Difference in pattern ... 31·60 }
Aver. recoil above 50lb. 37·74 } 74·84
Difference in recoil...... 5·50 }

Figure of Merit.............. 9·64

Pads, 25 sheets.

#### SAME GUN, WITH 45 grains SCHULTZE.

| LEFT BARREL. Penet. | Pat. | Recoil. | | RIGHT BARREL. Penet. | Pat. | Recoil. |
|---|---|---|---|---|---|---|
| 18 | 177 | 89 | ... | 14 | 184 | 82½ |
| 15 | 85 | 85 | ... | 16 | 129 | 86 |
| 24 | 134 | 86 | ... | 14 | 132 | 84 |
| 16 | 158 | 84½ | ... | 13 | 80 | 85 |
| 15 | 167 | 83 | ... | 16 | 171 | 85½ |
| 15 | 132 | 85 | ... | 15 | 166 | 84 |
| 12 | 64 | 86 | ... | 15 | 106 | 83 |
| 15 | 159 | 85½ | ... | 15 | 92 | 85 |
| 16 | 130 | 84½ | ... | 13 | 141 | 84 |
| 25 | 161 | 85 | ... | 16 | 111 | 87 |
| 15 | 105 | 85 | ... | 12 | 66 | 87 |
| 12 | 135 | 85 | ... | 16 | 138 | 86 |
| 22 | 107 | 83½ | | | | |

Average penetration × 6 ......... 94·80
Average pattern ......... 129·20
Difference in pattern ... 65·20 }
Aver. recoil above 50lb. 35·04 } 106·74
Difference in recoil...... 6·50 }

Figure of Merit......*minus* 11·94

Pad, 40 sheets.

#### MODIFIED CHOKE-GUN (BAKER), WITH 3½dr. CURTIS POWDER, No. 4.

| LEFT BARREL. Penet. | Pat. | Recoil. | | RIGHT BARREL. Penet. | Pat. | Recoil. |
|---|---|---|---|---|---|---|
| thro. | 80 | 90 | ... | thro. | 118 | 91½ |
| ,, | 108 | 91 | ... | 21 | 127 | 90 |
| 22 | 106 | 90 | ... | 23 | 143 | 91 |
| 21 | 119 | 90 | ... | 17 | 67 | 90 |
| 21 | 117 | 88½ | ... | 17 | 89 | 88½ |
| 22 | 124 | 89½ | ... | 21 | 123 | 90 |
| thro. | 114 | 89 | ... | 22 | 143 | 90 |
| ,, | 109 | 90 | ... | 18 | 108 | 89 |
| 22 | 118 | 90 | ... | 20 | 130 | 91 |
| 22 | 111 | 91 | ... | thro. | 133 | 89 |
| 21 | 125 | 89 | ... | ,, | 144 | 89 |
| 20 | 103 | 88 | ... | ,, | 128 | 89 |
| 18 | 92 | 88½ | | | | |

Average penetration × 6 ......... 131·52
Average pattern ......... 115·16
Difference in pattern ... 48·16 }
Aver. recoil above 50lb. 39·70 } 91·36
Difference in recoil...... 3·50 }

Figure of Merit.............. 40·16

Pad, 25 sheets.

## SHOOTING AT 50 YARDS WITH NO. 6 SHOT.

*(continued.)*

### CYLINDER GUN, MADE BY POWELL; WEIGHT, 7lb.; SHOT WITH

**3¼dr. PIGOU POWDER, No. 4.**

| LEFT BARREL. Penet. | Pat. | Recoil. | | RIGHT BARREL. Penet. | Pat. | Recoil. |
|---|---|---|---|---|---|---|
| 20 | 57 | 89½ | ... | 10 | 49 | 91 |
| thro. | 66 | 90 | ... | 21 | 96 | 89 |
| 22 | 53 | 89 | ... | 18 | 61 | 90 |
| 12 | 73 | 90 | ... | 20 | 78 | 89 |
| 23 | 61 | 89½ | ... | thro. | 63 | 90 |
| 20 | 72 | 89 | ... | 16 | 59 | 90 |
| 17 | 55 | 89 | ... | 0 | 18 | 90 |
| 21 | 60 | 90 | ... | 22 | 68 | 89 |
| 20 | 88 | 90 | ... | 24 | 94 | 89 |
| 18 | 91 | 90 | ... | 16 | 62 | 89½ |
| 19 | 73 | 89½ | ... | 19 | 74 | 90 |
| 21 | 66 | 88½ | ... | 12 | 73 | 90 |
| 17 | 69 | 90 | | | | |

| | | |
|---|---|---|
| Average penetration × 6 ......... | | 109·92 |
| Average pattern ......... | 67·16 | |
| Difference in pattern ... | 49·16 | |
| Aver. recoil above 50lb. | 39·62 | 91·28 |
| Difference in recoil ...... | 2·50 | |
| Figure of Merit.............. | | 18·64 |

Pad, 25 sheets.

**42 grains SCHULTZE.**

| LEFT BARREL. Penet. | Pat. | Recoil. | | RIGHT BARREL. Penet. | Pat. | Recoil. |
|---|---|---|---|---|---|---|
| 19 | 130 | 83 | ... | 12 | 44 | 86 |
| 20 | 76 | 81 | ... | 14 | 75 | 79½ |
| 0 | 25 | 80 | ... | 15 | 72 | 82 |
| 18 | 111 | 78 | ... | 12 | 75 | 78 |
| 16 | 65 | 77 | ... | 23 | 100 | 82 |
| 14 | 90 | 80½ | ... | 0 | 18 | 78 |
| 17 | 114 | 76 | ... | 9 | 35 | 82½ |
| 17 | 44 | 88½ | ... | 17 | 56 | 82 |
| 22 | 93 | 80 | ... | 19 | 109 | 82 |
| 18 | 139 | 81½ | ... | 17 | 101 | 78 |
| 16 | 74 | 81 | ... | 0 | 26 | 77 |
| 0 | 42 | 86 | ... | 17 | 116 | 78 |
| 17 | 67 | 78½ | | | | |

| | | |
|---|---|---|
| Average penetration × 6 ......... | | 83·76 |
| Average pattern ......... | 75·88 | |
| Difference in pattern ... | 57·88 | |
| Aver. recoil above 50lb. | 30·64 | 101·02 |
| Difference in recoil ...... | 12·50 | |
| Figure of Merit......*minus* | | 17·26 |

Pad, 25 sheets.

### CYLINDER GUN, MADE BY BAKER; SHOT WITH

**3¼dr. HALL POWDER, LETTER A.**

| LEFT BARREL. Penet. | Pat. | Recoil. | | RIGHT BARREL. Penet. | Pat. | Recoil. |
|---|---|---|---|---|---|---|
| thro. | 70 | 94 | ... | thro. | 94 | 89½ |
| 22 | 75 | 89 | ... | 21 | 83 | 87½ |
| 17 | 81 | 90 | ... | 17 | 68 | 89 |
| 12 | 83 | 89 | ... | 18 | 66 | 90 |
| 20 | 80 | 89 | ... | 17 | 77 | 88 |
| 21 | 82 | 90 | ... | 24 | 76 | 90 |
| 16 | 84 | 88 | ... | 18 | 56 | 89 |
| thro. | 64 | 88 | ... | 19 | 76 | 89 |
| 20 | 76 | 88½ | ... | 21 | 74 | 90 |
| 22 | 93 | 90 | ... | 16 | 63 | 88 |
| 19 | 84 | 88 | ... | 13 | 76 | 88½ |
| 16 | 86 | 87 | ... | 20 | 76 | 90 |
| 16 | 82 | 90 | | | | |

| | | |
|---|---|---|
| Average penetration × 6 ......... | | 115·20 |
| Average pattern ......... | 77·00 | |
| Difference in pattern ... | 21·00 | |
| Aver. recoil about 50lb. | 39·16 | 67·16 |
| Difference in recoil ...... | 7·00 | |
| Figure of Merit.............. | | 48·04 |

Pad, 25 sheets.

**45 grains SCHULTZE.**

| LEFT BARREL. Penet. | Pat. | Recoil. | | RIGHT BARREL. Penet. | Pat. | Recoil. |
|---|---|---|---|---|---|---|
| 15 | 48 | 86 | ... | 18 | 55 | 85 |
| 21 | 114 | 86 | ... | 20 | 98 | 82 |
| 20 | 77 | 84 | ... | 23 | 92 | 83 |
| 22 | 101 | 82 | ... | thro. | 112 | 83 |
| 22 | 97 | 81 | ... | 16 | 95 | 82 |
| thro. | 108 | 83 | ... | 24 | 104 | 82 |
| ,, | 96 | 82½ | ... | 19 | 93 | 83½ |
| 19 | 72 | 83 | ... | 19 | 96 | 83 |
| 18 | 90 | 83 | ... | thro. | 86 | 83 |
| 22 | 116 | 82 | ... | 22 | 128 | 81 |
| 22 | 94 | 85 | ... | thro. | 97 | 83 |
| thro. | 93 | 83 | ... | 21 | 83 | 83½ |
| 22 | 117 | 83 | | | | |

| | | |
|---|---|---|
| Average penetration × 6 ......... | | 128·40 |
| Average pattern ......... | 94·48 | |
| Difference in pattern ... | 46·48 | |
| Aver. recoil above 50lb. | 33·10 | 84·58 |
| Difference in recoil ...... | 5·00 | |
| Figure of Merit.............. | | 43·82 |

Pad, 25 sheets.

## AT 50 YARDS, WITH 1⅛OZ. NO. 5 SHOT.

CHOKE-BORE GUN, MADE BY W. W. GREENER; SHOT WITH

**3¼dr. PIGOU ALLIANCE POWDER.**

| LEFT BARREL. | | | RIGHT BARREL. | | |
|---|---|---|---|---|---|
| Penet. | Pat. | Recoil. | Penet. | Pat. | Recoil. |
| thro. | 116 | 86½ | thro. | 119 | 88 |
| ,, | 132 | 88 | ,, | 121 | 86 |
| ,, | 109 | 87 | 20 | 128 | 85 |
| 22 | 101 | 86 | thro. | 118 | 86 |
| thro. | 132 | 87 | ,, | 131 | 88 |
| ,, | 108 | 85½ | ,, | 98 | 86 |
| ,, | 110 | 86 | ,, | 118 | 87½ |
| ,, | 122 | 85½ | ,, | 137 | 87 |
| ,, | 123 | 86 | 22 | 122 | 86½ |
| ,, | 140 | 87 | thro. | 125 | 88 |
| ,, | 112 | 87½ | 20 | 95 | 85 |
| ,, | 123 | 87 | 23 | 125 | 86 |
| ,, | 142 | 86 | | | |

Average penetration × 6 ......... 145·68
Average pattern ......... 120·44
Difference in pattern ... 25·44
Aver. recoil above 50lb. 36·56 } 65·00
Difference in recoil ...... 3·00

Figure of Merit .............. 80·68

Pad, 25 sheets.

**SAME GUN, WITH 45 grains SCHULTZE.**

| LEFT BARREL. | | | RIGHT BARREL. | | |
|---|---|---|---|---|---|
| Penet. | Pat. | Recoil. | Penet. | Pat. | Recoil. |
| thro. | 77 | 81½ | thro. | 139 | 83½ |
| ,, | 108 | 83½ | ,, | 101 | 83½ |
| ,, | 153 | 85½ | ,, | 129 | 81 |
| ,, | 153 | 83½ | ,, | 124 | 83½ |
| ,, | 121 | 85½ | 23 | 142 | 83½ |
| 21 | 126 | 82 | 16 | 74 | 83½ |
| 23 | 145 | 84 | 23 | 145 | 82 |
| 21 | 145 | 82 | 22 | 137 | 84 |
| 22 | 135 | 84 | 22 | 145 | 82 |
| 21 | 118 | 84 | 20 | 125 | 82 |
| 22 | 137 | 81½ | 25 | 120 | 86 |
| 23 | 147 | 83 | 25 | 121 | 84 |
| 21 | 109 | 81 | | | |

Average penetration × 6 ......... 138·00
Average pattern ......... 127·04
Difference in pattern ... 53·04
Aver. recoil above 50lb. 33·18 } 91·22
Difference in recoil ...... 5·00

Figure of Merit .............. 46·78

The first nine pads consisted of 25 sheets, all of which were penetrated; the remainder were 40 sheets.

## AT 60 YARDS, WITH 1⅛OZ. NO. 6 SHOT.

SAME CHOKE-BORE GUN, BY W. W. GREENER; SHOT WITH

**3¼dr. PIGOU ALLIANCE POWDER.**

| LEFT BARREL. | | | RIGHT BARREL. | | |
|---|---|---|---|---|---|
| Penet. | Pat. | Recoil. | Penet. | Pat. | Recoil. |
| 13 | 87 | 87½ | 13 | 64 | 90 |
| 13 | 70 | 89½ | 12 | 62 | 89 |
| 12 | 78 | 89 | 11 | 98 | 90 |
| 12 | 117 | 87 | 13 | 104 | 86 |
| 11 | 80 | 84 | 14 | 108 | 83 |
| 12 | 93 | 84 | 10 | 67 | 86 |
| 10 | 96 | 88 | 14 | 106 | 84 |
| 13 | 107 | 85 | 11 | 111 | 86 |
| 14 | 82 | 90 | 13 | 99 | 88½ |
| 14 | 84 | 87 | 12 | 79 | 89 |
| 13 | 83 | 87 | 11 | 73 | 85 |
| 11 | 83 | 91 | 12 | 97 | 91 |
| 14 | 104 | 92 | | | |

Average penetration × 6 ......... 73·92
Average pattern ......... 89·28
Difference in pattern ... 27·28
Aver. recoil above 50lb. 37·54 } 73·82
Difference in recoil ...... 9·00

Figure of Merit .............. 0·10

Pad, 40 sheets.

**45 grains SCHULTZE.**

| LEFT BARREL. | | | RIGHT BARREL. | | |
|---|---|---|---|---|---|
| Penet. | Pat. | Recoil. | Penet. | Pat. | Recoil. |
| 16 | 144 | 81 | 10 | 42 | 86½ |
| 11 | 114 | 83 | 14 | 80 | 83 |
| 11 | 112 | 80 | 14 | 121 | 84 |
| 13 | 105 | 80 | 14 | 112 | 85 |
| 12 | 132 | 80 | 15 | 108 | 84 |
| 12 | 89 | 85 | 16 | 123 | 82 |
| 13 | 145 | 80 | 16 | 135 | 84 |
| 13 | 125 | 80½ | 13 | 110 | 84 |
| 12 | 100 | 80 | 13 | 130 | 83 |
| 11 | 112 | 78 | 14 | 106 | 83 |
| 14 | 107 | 85 | 16 | 126 | 85 |
| 12 | 82 | 82 | 13 | 134 | 85 |
| 16 | 76 | 82 | | | |

Average penetration × 6 ......... 80·16
Average pattern ......... 110·80
Difference in pattern ... 68·80
Aver. recoil above 50lb. 32·60 } 109·90
Difference in recoil ...... 8·50

Figure of Merit ......*minus* 29·74

Pad, 40 sheets.

### AT 60 YARDS, WITH 1¼OZ. NO. 5 SHOT.

**SAME GUN, WITH 3⅛dr. PIGOU ALLIANCE.**

| LEFT BARREL. | | | RIGHT BARREL. | | |
|---|---|---|---|---|---|
| Penet. | Pat. | Recoil. | Penet. | Pat. | Recoil. |
| 14 | 89 | 86 | 13 | 102 | 87 |
| 12 | 70 | 86 | 13 | 94 | 86 |
| 11 | 86 | 85 | 13 | 91 | 86½ |
| 13 | 84 | 86 | 15 | 104 | 86½ |
| 12 | 80 | 86 | 12 | 107 | 87 |
| 9 | 91 | 86 | 10 | 52 | 88 |
| 13 | 87 | 86 | 12 | 83 | 87 |
| 10 | 61 | 87 | 16 | 101 | 87 |
| 16 | 86 | 87 | 14 | 104 | 86½ |
| 14 | 67 | 86½ | 13 | 81 | 85 |
| 12 | 103 | 86 | 15 | 108 | 88 |
| 14 | 90 | 86 | 14 | 107 | 86 |
| 12 | 93 | 86 | | | |

Average penetration × 6 ......... 77·04

Average pattern ......... 88·84

Difference in pattern ... 36·84 }
Aver. recoil above 50lb. 36·40 } 76·24
Difference in recoil ...... 3·00 }

**Figure of Merit** ............... 0.80

**Pad, 40 sheets.**

**SAME GUN, WITH 45 grains SCHULTZE.**

| LEFT BARREL. | | | RIGHT BARREL. | | |
|---|---|---|---|---|---|
| Penet. | Pat. | Recoil. | Penet. | Pat. | Recoil. |
| 13 | 62 | 88 | 13 | 97 | 84 |
| 15 | 81 | 83 | 17 | 109 | 84½ |
| 15 | 85 | 81 | 13 | 67 | 84 |
| 17 | 106 | 81½ | 16 | 88 | 85 |
| 17 | 114 | 84 | 15 | 109 | 84 |
| 18 | 103 | 83½ | 14 | 130 | 85 |
| 14 | 95 | 83 | 14 | 103 | 84½ |
| 14 | 92 | 81½ | 0 | 86 | 82 |
| 15 | 77 | 79 | 15 | 100 | 84 |
| 17 | 112 | 83½ | 12 | 89 | 80 |
| 18 | 115 | 85 | 16 | 92 | 85 |
| 15 | 61 | 84 | 18 | 93 | 85 |
| 17 | 110 | 84 | | | |

Average penetration × 6 ......... 88·32

Average pattern ......... 95·04

Difference in pattern ... 34·04 }
Aver. recoil above 50lb. 33·52 } 76·56
Difference in recoil ...... 9·00 }

**Figure of Merit** ............... 11·76

**Pad, 40 sheets.**

# CHAPTER IV.
## CONSTRUCTION OF THE GUN.

### SECTION I.
#### The Barrel or Barrels.

Whatever may be the kind of gun about to be made, the first thing done is to forge the tube or tubes containing the charge. Formerly they were all made of plain iron, but for the last hundred years the barrels of all best guns have been constructed either of strips or twisted iron coiled spirally round a mandril, and welded together by heat, or of steel. At present the selection is from three kinds, viz., first, Damascus; second, laminated steel; and third, plain steel.

Plain iron is only used for the very cheap guns intended for the foreign market, and I shall therefore only allude to it here in the most cursory manner. The other three kinds must, however, be more fully described.

The chief difficulty in the present day is to obtain iron of sufficiently good quality to mix with the steel, whether for Damascus or laminated barrels. Formerly horseshoe stub nails were alone thought good enough; but of late years these have fallen off in quality, and are also insufficient for the supply of the increased demand for shot guns since the passing of the present game law. These stubs, generally mixed together with other "scraps," were welded together and forged into bars; but in the present day new iron is alone used, selecting the best quality in the market, and refining it by melting and puddling, after which it is submitted to the

tilt hammer, by which its fibres are condensed and drawn out. Swedish steel is treated in a somewhat similar manner, and then the material is ready for the barrel forger, who proceeds as follows :

Bars of equal length are laid together or "faggotted," and heated in a furnace, after which they are put under the tilt hammer, and hammered again and again, so as to condense the fibres, and weld the iron and steel together. The bars thus treated are cut into lengths, again "faggotted," and put in the furnace, when they are hammered into narrow strips of the desired width, as presently to be described.

According to the kind of barrel intended is the proportion of steel and iron, and also the treatment of these metals by the barrel maker. Thus—

In single iron Damascus the two metals are in nearly equal proportions.

English steel Damascus is composed of six parts steel and four of iron.

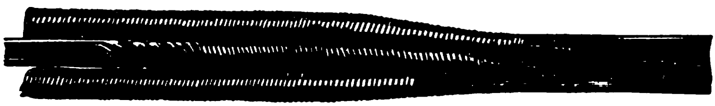
Silver steel Damascus has nearly eight parts steel and two or two and a half of iron.

Laminated steel is composed, like English steel Damascus, of about six parts steel and four of iron. The sole difference in fact between steel Damascus and laminated steel consists in the manipulation of the rods, which are less twisted in the latter than in the former, but more hammered to produce firm welding and condensation of the fibres. Excessive hammering of Damascus iron interferes with the beauty of the figure.

With the exception of plain steel barrels, all those for shot guns are welded by heat as above described, and wherever steel enters into their composition, wholly or in part, great care is necessary not to overheat them, as by that means its tenacity its materially reduced.

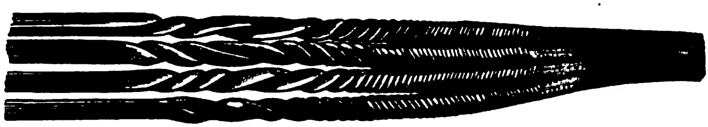
The process of forging twisted barrels is as follows : A rod is first heated, and then twisted into a spiral form by means

of two iron bars, one fixed, and the other held in a notch of a machine, which is turned by a winch handle, so as to effect the twist. These rods are then treated according to the quality of the barrels to be forged. Thus, for very common guns a single rod of iron is slightly twisted, and hammered when hot into a



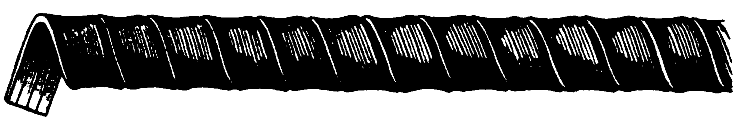
THREE TWIST.

flat band. For the next kind two twisted rods of steel and iron are welded into a band. Successive qualities are formed of three, four, five, or six twists of alternate steel and iron, the most common being three and four twist, as shown in the



FOUR TWIST.

annexed illustrations. The next operation is similar in principle for all guns, though it varies in the degree of manipulation. It consists in twisting one of these bands, spirally round a mandril, as in the woodcut in which "four twist" is shown;



TWO SPIRALS WELDED TOGETHER IN THE MIDDLE.

but the appearance in the several twists differs only in the number of lines separating the rods of which the band is composed. When the rod is thus twisted it is allowed to cool, while others are twisted in the same way; and the next process is for the smith to join the edges by welding them

under the hammer at a white heat, at the same time placing the twist with its mandril in a semi-circular groove, and turning it constantly under the hammer. When thoroughly welded a second portion is placed on the same mandril, and the two are heated together, after which, by "jumping" and hammering, they are welded into a continuous tube. By repeating this operation again and again the proper length is obtained, and the barrel is completed in the rough. Finally, light hammer-hardening completes the operation. In the process of forging the barrel forger commences at the breech end with thick bars, and gradually reduces the substance by selecting them of lesser dimensions.

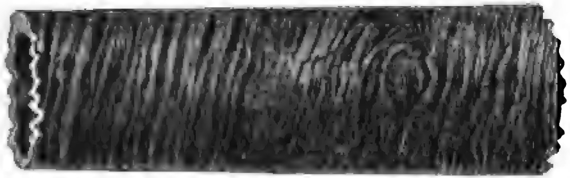
Plain barrels for the foreign market are forged by bending a flat ribbon of iron round a mandril without any twist, and then welding the edges together.

Damascus barrels are of various kinds, those in most general use being as follows:

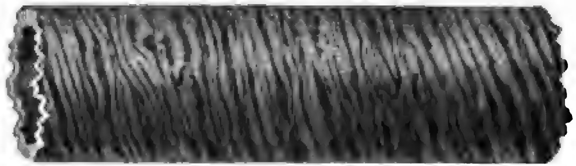
1. Single iron steel Damascus, made of a single twisted bar rolled out into a wide ribbon (seven-eighths of an inch wide), gradually reduced in thickness from the breech to muzzle. This is known as common twist, or skelp.
2. Two-stripe steel Damascus, made from two twisted rods rolled into a ribbon five-eighths of an inch wide, and reduced in thickness as before.
3. Three-stripe steel Damascus, made with three twisted rods three-eighths of an inch wide, and also gradually reduced in thickness from breech to muzzle.
4. Fine Damascus barrels, chiefly made in Belgium, are made from four, five, or six rods by different makers.
5. Silver steel Damascus is made up of three or four rods with steel of a superior quality.

These several qualities, as well as some others, are shown in the annexed engraving, the drawings for which are from specimens of English (Marshall's) and foreign barrels shown

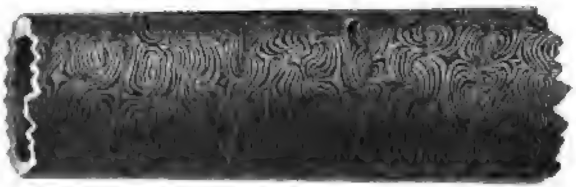
Common Twist or Ruban (Belgian).



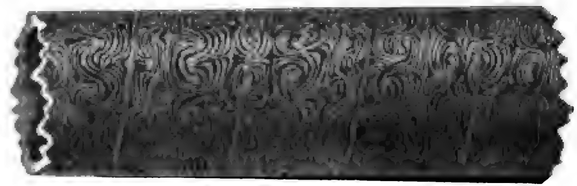
Common Twist or Skelp (English.)



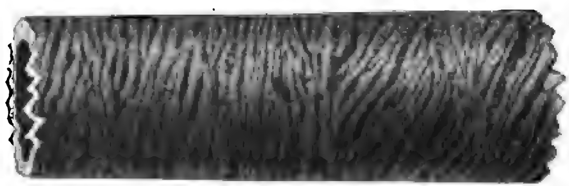
Two Stripe (Belgian).



Two Stripe (English).



Laminated Damascus (Belgian).



Laminated Damascus (English).

FIGURES SHEWN BY BELGIAN AND ENGLISH BARRELS.

*Face page 86.*

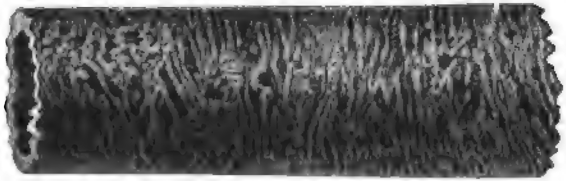
by Messrs. Bland and Sons at the Sportsman's Exhibition, held at Islington in July, 1872.

For the following description of the methods adopted in Belgium for forging gun barrels of fine Damascus, I am indebted to Mr. Thos. Webley, who, soon after the *Field* Gun Trials of 1879, visited Belgium, with a view to discover the reasons why the barrels forged there are more free from flaws than those made at Birmingham.

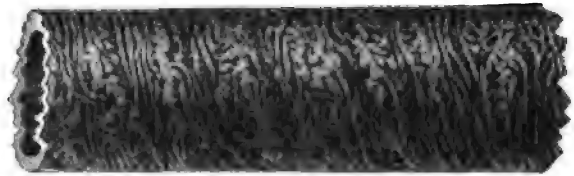
A large quantity of Belgian tubes, called "Pointille," similar in figure to our iron Damascus (often called laminated steel) have been used in cheap guns for the last three years, and these are especially wanting in toughness and density of metal. These tubes are cheaper than iron Damascus made at Birmingham, are more regular in figure, and have fewer greys, but the result is obtained at the entire sacrifice of density and toughness of metal; for it is a fact that, though these tubes may stand proof, the iron is so soft and rotten that they will not wear or stand any extra or repeated strain. These remarks apply, but in a smaller degree, to all Belgian tubes, whether iron Damascus (Pointille), or Damascus (Damas turc). As one proof of this, when you see a choke-bored barrel bulge at the choke, it is almost sure to be a Belgian tube. We were, in common with our competitors, excepting for first and second quality, using a large proportion of these tubes; in fact, we think that quite three-fourths of the tubes used in Birmingham are Belgian make, and nearly all the London trade use them, with this difference, that they use the best quality, which are no doubt harder than the cheaper kinds, but are still softer and less durable than those of English make, and cost as much. Now we have for a long time felt very dissatisfied with this state of things, and determined to step out of our province as gunmakers and turn our attention to iron making, believing that the first fault lay there. For many years we have been almost entirely dependent upon one maker for Damascus, stub Damascus, and laminated steel iron; he, having a monopoly, has not cared to trouble himself to keep his iron up to its original good standard, notwithstanding the fact that, in consequence of its high price and want of clearness (freeness from greys), his trade has been gradually leaving him and going to Belgium. As you probably are aware, the mode of making gun-barrel iron, so as to give the various kinds of figure, is

kept a close secret by the iron makers; we therefore had to begin with a very indistinct notion of what we were about to do. Fortunately, we made the acquaintance of Mr. Smith Casson, the manager of the Earl of Dudley's Round Oak Ironworks—these works are of the most advanced type in the kingdom—and he kindly placed at our disposal all the resources of the establishment that we required, and gave us the benefit of his great experience. The first batch of iron that we made, although not just the figure we expected, turned out very well, was very clean, and of first-rate quality, as well as much cheaper. After making several other lots, our Mr. Thomas Webley, accompanied by Mr. Smith Casson, paid a visit to the barrel making districts of Liège, where they were singularly fortunate in getting to the bottom of the Liège system of making their various kinds of iron. They found that each barrel maker piled his iron and steel (very little of the latter, and that of the softest kind, so as to weld easily) into a faggot; it was then sent to the ironworks, put into a furnace, and, when heated sufficiently, rolled off into a billet, and then sent to the smaller mill, re-heated, and rolled off into square rods; if intended for barrels, the rods had to be twisted, varying, of course, in size, as to whether they were intended for one, two, three, four, or six striped barrels; but if for what we call skelp twist (they call them "ruban") it is at once rolled off into flat rods of one width, varying in thickness for the breech and muzzle ends (though the additional thickness at breech ends is often obtained by first wrapping a piece of plain iron round the mandril). You will perceive that up to this stage the iron has not had one blow from a hammer, consequently it is not at all hardened or toughened; but the piles lie more evenly than they would have done if the faggot had been put under a steam or tilt hammer, and hammered into a billet, as we do here, instead of being rolled right off. Now comes the next stage of welding proper. In consequence of the Belgians welding all their barrels on a chemise—which is a strip of common sheet iron of the necessary length and width, bent round a mandril, so that it forms a complete tube, round which the rods of iron are then wound—they are enabled to make a pair of ordinary breech-loading tubes out of about 12lb. of iron, without the lining, instead of 17lb., which it takes us. This result is that they work iron much nearer the finished size than we do, and but for the support of the chemise, they would not be able to carry the barrels when hot from the fire to the anvil. It thus necessarily only

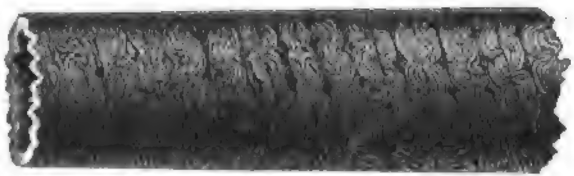
Stub Iron Damascus (Belgian).



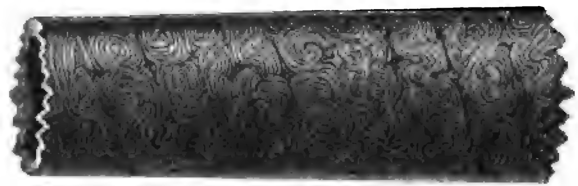
Stub Iron Damascus (English).



Best Damascus (Belgian).



Best Damascus (English).



Best Laminated Steel (English).

Best Stub Damascus (English).

FIGURES SHEWN BY BELGIAN AND ENGLISH BARRELS.

*Face page 89.*

receives just sufficient hammering to weld the joints together, and is not hammered and reduced in thickness along its entire length, as we do here, which hammering greatly adds to the density and strength of the metal. Of course the amount of up-jumping and hammering that a barrel receives here (independently of the original quality of the iron) depends upon the quality of barrel it is desired to make, as more hammering and up-jumping means more iron, fuel, and the labour of three men.

On remarking to some of the Liège makers that their barrels were sure to be soft made on their principle, and that that was the great objection we had to Liège tubes, their reply was that they only studied three things: First, to get the greatest possible distinction in colour (black and white when browned) between their iron and steel; secondly, regularity of figure; thirdly, clearness of iron; and that whether they were hard or soft was of no consequence to them.

P. Webley and Sons.

Laminated steel barrels were introduced by Mr. W. Greener (father of the present Mr. W. W. Greener) about thirty years ago, and are now nearly as generally used as Damascus. At first he employed a larger proportion of steel than is now used, but finding this too brittle the quantity was gradually reduced, and in the present day there is little or no difference in the proportion of the two metals used in Damascus and laminated steel. Mr. Greener in his book published in 1858 describes his process as follows, and his plan is still followed:

I generally have the metal required cut into short pieces of six inches long. A certain number are bundled together and welded, and then drawn down again in the rolling mill. This can be repeated any number of times, elongating the fibres and multiplying their number to an indefinite extent, as may be required.—*Gunnery in* 1858, p. 154.

In the very interesting collection of Messrs. Bland, English and Belgian Damascus barrels are contrasted as to their appearance; but no appreciable external difference is discoverable in the laminated steel of the two countries, and I have not therefore given an example of the Belgian make.

Steel barrels are either made of ordinary steel drawn while cold by steam power through a succession of gauges, or of what is called by Mr. B. Whitworth his "compressed steel." The latter is now the only steel employed in the shot gun trade, and no doubt gives excellent results, being more elastic than Damascus or laminated steel, and also capable of bearing a greater strain in proportion to its substance. Gun barrels can therefore be made several ounces lighter of this material than of either of the other two materials in common use, and at the same time they give better shooting, both in regularity of pattern and also in penetration. The price is, however, somewhat higher, and as greater care is necessary in brazing them, and the metal is harder to bore, the charge for putting them together by the barrel maker and boring them is also increased, raising the price of a double gun about 2*l.* or 3*l.* The ribs are made of the same material as the barrels, so that when put together they match in appearance.

The barrels having been thus forged separately, with squares on one side at the breech end for the reception of the lump required for actioning, they are next bored and ground; after which, if for double barrels, they are "put together." English forging is now altogether done at Birmingham, no barrels having being forged in London for many years. A good many are, however, still put together in London, and this trade is called that of a barrel *maker*; but in all cases the tubes he uses are obtained by him in a more or less finished state either from Birmingham, Belgium, or France. Until I drew attention to the general use of Belgian barrels in the *Field*, a very large proportion of those sold in London were Belgian, and also many of those sent out by the Birmingham gunmakers. The excuse for this was that the Birmingham barrels were full of "greys," and that the makers would not warrant them to be free from these defects, so that many first-

class guns were reduced to a second class during the finishing process, prior to which the greys were not detected. But for the last two or three years Mr. Marshall, of Birmingham, has improved his manufacture so much, and sportsmen have so firmly insisted on the use of English iron, that the trade has in great measure returned to the seat of the English gun trade. Excellent barrels are no doubt forged at Liège in Belgium, and at St. Etienne in France, but the bulk of the foreign barrels are very inferior in hardness to those made of Marshall's iron.

The boring is effected by three stages—first, rough; second, fine; and third, lapping or lead polishing.

In rough boring a spindle is made to revolve rapidly in a horizontal frame, with a head of such a shape as to receive a square tool made of steel, and called a "bit," about five feet long. The barrels are put on this bit, and are then fixed in a carriage which traverses a bench, and are forced forwards towards the spindle by a lever acting on a rack. As soon as one bit has worked its way through the barrel a larger one is substituted for it, and so on until the desired gauge is obtained. Hollows are occasionally found to exist in this process, and when detected the barrel is returned to the forger to have them hammered down. A stream of cold water is kept running over the barrels to prevent heating.

The next process is to straighten the barrels inside, for the bit does not leave them perfect in this respect, the boring cutting more or less deeply according to the soft or hard nature of the metal at each part. The first thing to be done is to ascertain where the defects exist, beginning at one end, and no machine has yet been invented which will do this so well as the naked eye applied in the following way, and calling "shading" a barrel. Holding the barrel slanting upwards towards the light, the shadow of some sharply defined object is made to fall on its sides. If the lines so made are straight,

these sides are parallel and straight, but if not, the "setter," with his hammer, makes them so, and then proceeds to turn the barrel round on its long axis, applying his hammer when necessary, until these lines remain straight while the barrel is being turned, when the interior is considered to be a true cylinder. Next to the eye in efficiency is a small lamp, applied so as to throw its light through the barrel upon tissue paper fixed in front of the muzzle. The light is then reflected in the shape of a dark shade along the bottom of the barrel, and the curve or straight line thus made, as the case may be, is a measure of its internal condition.

As soon as the interior is thus made true, the external ends are turned in a lathe down to the proper substance at each end, and also at several fixed distances, the intervening superfluous metal being afterwards removed by the grindstone, beginning with a rough one and ending with a very smooth one. Before this process is finished in best barrels, the fine boring bit is substituted for the rough bore. This bit is also square, but instead of all its edges being sharp, one only is in that condition, and it is made to do its work by strips of wood and paper, called respectively "spills" and "liners," applied on one side; but for ordinary work the boring is completed before the grinding is commenced. Lastly, the circular marks of the grindstone are removed by working a tool called a "float" longitudinally, and then the tubes are ready for first or provisional "proof," which is done by screwing in a plug at the breech end, with a hole in it for firing (see page 19). As may be expected, in the above processes there are always some irregularities, and if these do not correspond, certain parts of the tubes are thicker and others thinner than they should be, and attempts have been made to avoid this source of weakness, but none of which I am aware have yet been attended with complete success.

When it is intended to choke-bore the barrel, the muzzle is

left two or three sizes smaller than the intended gauge, by not forcing the fine-bore bit quite up to it. Another bit, of the proper shape for the particular form of choke intended, is then substituted for the fine-bore bit, and by carefully using this and following it if necessary by a leaden "lap" of the desired shape and coated with oil and emery, the choke boring is finally effected. While the lap is revolving at a high speed, the barrel is moved backwards and forwards on it so as to prevent sharp gradations in the choking. The various forms of choke will be described hereafter.

After provisional proof the barrel is again "shaded," and carefully inspected to discover any flaws or cracks which the proof may have developed, or any deviations from the true line. If flaws are found to exist the barrel is put on one side for inferior purposes, or if it requires "setting" this is done, leaving the selected barrels ready for "putting together."

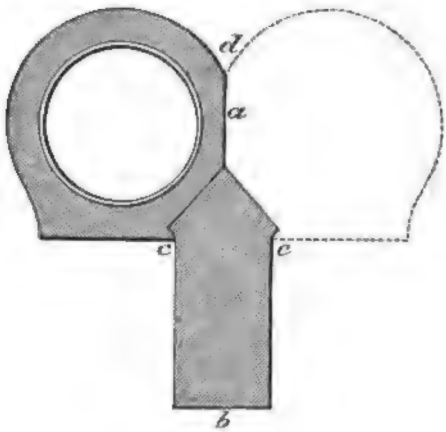
## SECTION II.

### Putting Together.

If very stout breeches are required a large amount of this part of the barrel is filed off on one side before putting them together, or the axes would not be in the proper lines for giving a true aim by both on the same spot at forty yards. This filing is therefore always in proportion to the stoutness of the breeches. Of course, a corresponding thickness of the solid projection left on the barrels is also filed off at *a* (see cut), the thickness of metal thus removed after first proof varying from one thirty-second to one-sixteenth of an inch or thereabouts, according to the stoutness of the breeches.

The next thing done is to fit a piece of steel called the "lump," *c c b*, from two to two and a half inches long, one deep, and half an inch thick, beneath and between the barrels,

to be securely brazed to them. In the early days of the Lefaucheux breechloader this lump was merely fitted to the plane surfaces left between the two points *c c*, but, finding the brazing sometimes give way, the lump is now made to point upwards between the barrels, as shown in the engraving at *c c a*, by which the brazed surface is nearly doubled. This is also now generally made still more secure by a dovetail cut on each side of the barrels, to which the lump is carefully fitted, as shown at *c c*. Of course the strength of this dovetail depends on the cohesion of the barrels to one another,




SECTIONS OF BARRELS AND LUMP AS "PUT TOGETHER."

which is maintained by the whole brazed surface; but, so long as the brazing remains sound, the iron itself at *c c* must be torn away before the dovetail ceases to act. Some barrel makers prefer cutting away still more of each barrel, and carrying a thin plate from the lump up between them; but, though this to a slight extent increases the adhesion of the lump, it is at the expense of the barrels; and, as it is done after first proof, it diminishes the security of that supposed safeguard. Others again introduce a couple of pins dropped into the lump from between the barrels; but these also neces-

sitate a weakening of the barrels, and on the whole I consider the dovetailed lump, as shown above, to be the best. An attempt has been made to effect the same purpose by forging half the lump on each barrel, and carrying the brazing all through; but this often interferes with the actioning, and moreover the steel thus forged on cannot be made so hard as that of the lump afterwards brazed on.

After carefully fitting the lump, the barrels are ready for brazing, which is done in the usual way for about three inches, the parts being held together by wire while in the fire. If a "top extension," to be presently described, is intended to be used, a piece of steel of the proper shape is at the same time brazed on at *d* between the barrels, projecting from them usually from three-quarters to half an inch, and lying between them for about two inches.

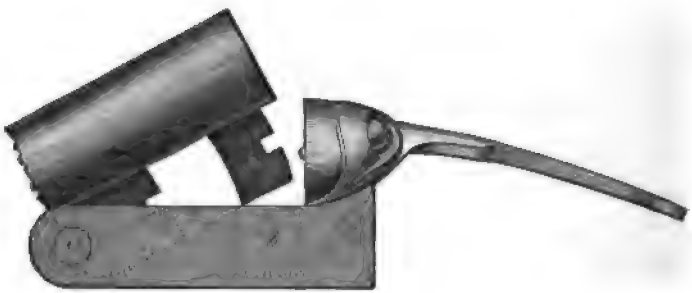
When the brazing is completed the wires are removed, and the ribs above and below are fitted and soft-soldered in their places. The barrels are then ready for actioning; and usually the skill of the barrel maker has enabled him to put them together so that the aim of both at forty yards shall be on the same spot. Sometimes, however, when regulating the shooting—which cannot be done at this stage—they either shoot wide, or cross, or one may be up and the other down. If so, the "regulator" heats the muzzle for a few inches, so as to loosen the solder, and alters their relative position accordingly, after which they are again soldered as before.

## SECTION III.

### Actioning.

When the barrels are prepared as above described, it is necessary that their breech ends shall be closed in such a way that they can be readily opened and closed again. This is

now almost invariably done by some one or other of the various modifications of the Lefaucheux or "drop-hinge" plan. But whatever the modification adopted, an L shaped piece of iron is required, hinged in front of its horizontal limb to the lump of the barrels, and having its perpendicular limb maintained in apposition with their open mouths by a bolt or bolts capable of being readily withdrawn. This piece of iron is called the breech-action, and should be made of the best stub iron; but in many cheap guns it is of the commonest scrap—or it is sometimes even cast of malleable iron. The perpendicular limb is named the "break-off," not because it does break off in use, but because, in muzzleloading



PURDEY BOLT ACTION.

guns, the barrels came away or broke off from the stock at that part. Nevertheless, it sometimes earns its name by breaking off at the angle between the two limbs. In the various forms of actioning, this breech action is slotted in different ways, but nearly all agree in one point, viz., that the shock given to the hinge-pin by the explosion of the powder shall be partly borne by a wedge cut out of the lump (see engraving), *a*, dropping into a corresponding slot *b*, cut in the breech-action—the surfaces of each describing circle drawn from the centre of the hinge joint *c*. When these are thus cut and carefully fitted, a bolt or bolts varying in form is or are fitted so as to connect the two at the will of the shooter. At

first, Lefaucheux introduced from below a strong pin, worked perpendicularly by a lever lying under the trigger-guard, and furnished with a tooth which he called a grip. This was soon found to wear, and another tooth was added for English use, the action being entitled a "double grip," and this is still adopted for heavy rifles, but, as it will not completely snap together in closing, it is superseded for ordinary shot guns by what is called a snap bolt. Many forms of this bolt are used, but that known as the Purdey "snap" is almost universally adopted with or without assistance. It is a very strong one, and perhaps stronger than the double grip, but as it must play freely in order to snap home, while the double grip has a wedge-like form, the latter binds the parts together more closely, and in it more allowance can therefore be made for wear, it being fitted very tightly till after the gun is in all other respects ready for sale, when a final touch of the file puts it right for the customer.

These several fittings are aided by more or less complicated machines, and in Birmingham, nearly the whole of this work is now done by steam power, but in London the action-filers generally use the foot lathe. In every case the slots for the introduction of the lump into the action, and those for the bolts, are cut by special tools, and then the barrels are lowered into their places so that the hinge joint can be made by boring a cross hole through both, while the barrels are raised as if for loading. When this joint is made, they are gradually lowered to their places by the aid of "blackening" in the gas burner, and the file, the latter cutting away the parts shown to touch by the removal of the lamp black on contact.

Of course, if there is a "top extension," it also has to be fitted into the break-off before the bolts can be inserted. On these general principles all drop actions are fitted, the varieties being described under the particular actions to be hereafter mentioned.

## SECTION IV.

### Chambering.

This is generally done before the actions are fitted, but sometimes it is deferred till afterwards. It is, however, best done before hand, as otherwise the head of the cartridge cases may not be quite flush with the face of the break-off. The chambering is done by introducing into the original tube a cutter working on a guide, which fits the interior of the barrels, so that it must cut them equally all round. This cutter, made of steel, is turned in two sizes, one, as before mentioned, fitting the barrels, the other, exactly the length of the proposed chamber, being nearly large enough to fit a hole which will take the cartridge, but not quite, so that it may be afterwards smoothly finished out. The enlarged part is tapered off to the desired shape, and then one-half of the metal is cut away, leaving still the guide entire, while the enlarged portion has two cutting edges. With this tool, which is forced forward by the ordinary rest in the lathe, a rough chamber is soon cut, and then the extractor is fitted by drilling holes in the lump and between the barrels, at the same time cutting away the lower edges of the chambers to receive it. Then, leaving in the extractor, a finishing tool is driven in as before, made with the round cut into a fluted pentagon, so that it shall leave the chamber capable of taking the cartridge freely. Under the head of cartridges I shall describe the exact size of the chamber suitable for each case. The general rule is to bore it about ·003 inch larger than the case it is intended for.

## SECTION V.

### Percussioning and Filing-up.

Supposing now that one of the several forms of action has been completed, with its bolts properly fitted, before it can be

proved definitively, the means of explosion must be given to it. In the ordinary muzzle-loaders this was called percussioning, and consisted in the introduction into the breech of a nipple for the cap, and in the addition to the lock of a hammer to explode it. Since the adoption of the breechloader this is superseded by placing the cap in the cartridge case, and the percussioner has, therefore, only to drill a hole in the break-off in order to place in it a striker which shall give the necessary blow to the cap, and this is done in various ways at the proof-house, according to the nature of the action. As this hole is afterwards used, more or less enlarged, for the introduction of the striker, it must be central with regard to the chamber, and to effect this a solid dummy cartridge is fitted in with a sharp spike projecting from its centre, which is driven against the break-off from the muzzle, leaving a small punch mark, which serves as a guide for the drill. The barrels and action are now ready for final or definitive proof, being placed in a block of wood, which travels in a rack, and each barrel being fired separately, after which they are submitted to hot-water pressure under the blow of a hammer applied to a plug in the muzzle, a test which speedily shows the smallest crack or flaw made by the explosion of the powder.

It will be observed that it is not necessary before final proof to shape up the back of the break-off, or to fit the locks to it, as is afterwards always done in the modern hammerless gun, so that a certain quantity of metal may, after proof, be removed without detection from every part but the only one from which it is from another cause impossible. I allude to the part of the action to which the barrels are fitted. From this of course no metal can be removed, because by so doing the fit would be spoiled, and yet this is the part selected for the proof mark. To this subject I have already alluded at page 14, and I only return to it here as being more intelligible than it was before the above description.

## SECTION VI.

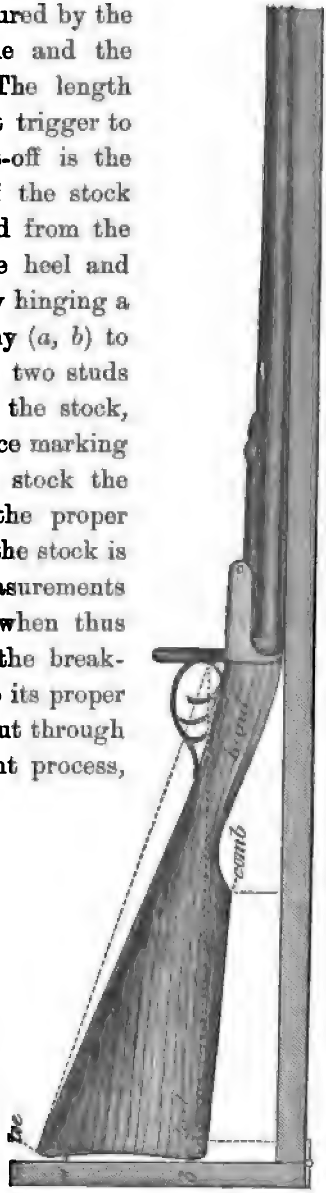
### Stocking.

When the gun has been proved, the next process is to insert the action in a piece of walnut wood properly seasoned. At this stage in hammered guns the lock plates are more or less jointed up to the actions, but in those without hammers, before stocking, the lock plates, if there are any, or in any case the plates on which the locks are built, must be jointed and screwed up to the action in order to insure the proper position of the tumblers with regard to the strikers. This being done, the stocker, by means of a mallet, chisel, gouge, &c., drops the action and its strip or tang into the wood, which is always kept ready prepared in the rough for this purpose, of a shape somewhat resembling its final condition. Before beginning this work he has received orders (if the gun is to be first class) as to the amount of bend and cast-off to be given it, and is careful to leave wood enough to allow for them. For this purpose he is provided with a machine upon which the barrels are laid, taking care that the rib lies along the central line; and then, having adjusted the wood to it so that the several measurements given him can be finally carried out in finishing off the wood, he fits the front of the stock to the back of the break-off, and lets in the tang. The usual measurements are as follows :

Usual Measurements of English Guns.

| | Inches. |
|---|---|
| From front trigger to middle of heel ... ... | $14\frac{1}{2}$ |
| „ „ to middle of toe ... ... | $14\frac{3}{4}$ |
| From comb to machine ... ... ... ... ... | $1\frac{1}{2}$ |
| „ heel „ ... ... ... ... ... | 2 |
| Cast-off at toe ... ... ... ... ... ... ... | $\frac{3}{8}$ |
| „ heel ... ... ... ... ... ... ... | $\frac{3}{16}$ |
| Length from barrel to comb ... ... ... ... | 7 |

The amount of bend is measured by the distances between the machine and the comb and heel respectively. The length of stock is that from the front trigger to the toe and heel, and the cast-off is the amount of laterial deviation of the stock from the straight line continued from the rib, which usually varies at the heel and toe. This is easily measured by hinging a perpendicular piece of mahogany (*a*, *b*) to the bottom piece, and inserting two studs at *a* and *b*, projecting towards the stock, which allow of the stocker at once marking off on the toe and heel of the stock the centres of those parts with the proper allowance for casting-off when the stock is finished. As soon as these measurements are all set out on the stock, when thus properly fitted to the back of the break-off, the trigger-plate is let in to its proper depth, and the breech-screw is put through the stock into it; this important process, upon which sound stocking mainly depends, being called "screwing together." The locks are now let into the wood, and then the stocker proceeds to "make-off," that is to say, to shape his work, guided by the several measurements already mentioned. In doing this, he has to leave the "hand" of the proper size; and here he is guided by the kind of lock he

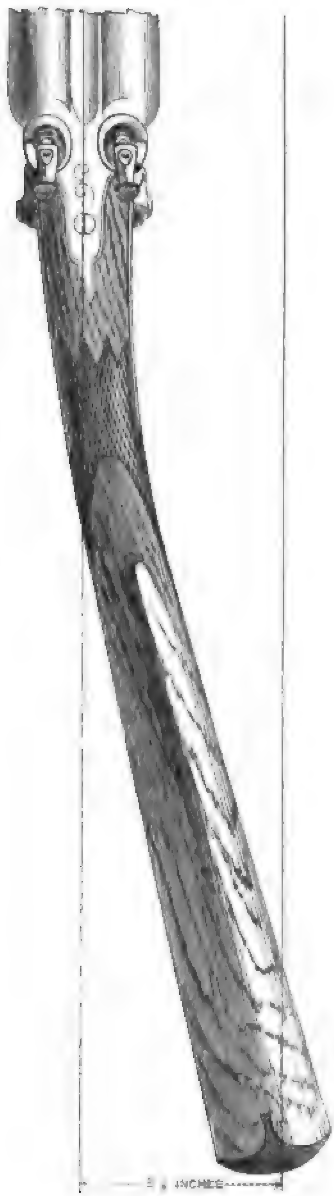



GUN STOCK MEASURER.

has to let in. If a "bar lock," the hand may be smaller than for the back-actioned lock, and this is the only excuse which can be given for the general preference of the former; for though in former days the back-actioned lock of the hammered gun could not be made to "speak," as it was called, like that of the bar lock, there is now little difference between them, and in hammerless guns none whatever. Still there is, no doubt, a general prejudice in favour of bar locks, and if only the action is made proportionately safe, there is no objection to them. In any case the stocker has to leave his hand of the proper size for each, varying from a circumference of 4½ to 5 inches in the bar lock to 6 inches in the back-actioned lock. If the object is to obtain a very light gun, the stocker selects a light and porous piece of wood, the difference between dense and open walnut being often 6 or 7 ounces in a single stock. Mr. Turner, of Birmingham, cuts away a hollow on each side to still further diminish the weight; but it is better in point of looks, and also in regard to strength, to cut out three holes in the stock with a centre-bit, bored from the butt, closing them with a heel-plate of vulcanite. Whichever of these practices is adopted tends to alter the balance of the gun, and this in the modern choke-bore is already inclined to be too forward, on account of its necessarily stouter muzzle. Every sportsman knows how completely his aim depends on this balance, if already accustomed to the gun; but a novice can, no doubt, accommodate himself to one balance almost, though certainly not quite, as well as another. Without doubt, a gun which naturally "comes up" to the shoulder, with the barrels in a horizontal position, is easier to learn to shoot with than another in which the muzzles have a tendency to droop. As soon as the above work is done, and the fore-end fitted, the gun is ready for "regulating," for which purpose it is placed in the hands of the person appointed to shoot it.

### Cross-eyed Stocks.

When the right eye is blind, the sportsman must either shoot from the left shoulder, or he must adopt some expedient for using the gun from the right side so as to get the left eye to bear on the sight. If he is naturally left-handed he soon learns to adapt himself to the former plan, but if not it is a very long time before he can carry it out, and often he does not succeed at last. The usual practice is to cast off the stock between the comb and break-off a little more than the space between the centres of the two eyes, as shown in the engraving annexed, so as to enable the left eye to take aim along the barrel. On measuring the space between the eyes, it will be found to average 2½in., but by adjusting the head to the line of sight less than this may in many cases suffice, and in some few instances fairly good shooting has been obtained with a cast-off of less than half that amount. But it will



Cross-eyed Stock made by Messrs. J. and W. Tolley.

be found that the gun stocked in this way shoots considerably to the left of the aim, owing to the left hand giving way, and in so doing the stock bruises the cheek. Hence I have almost always heard from left-eyed men that they could do best with a full 3in. deviation of the stock to the left, as set out in the engraving.

The usual method of shaping these cross-eyed stocks is to cut two obtuse angles in them, so as not to interfere with the locks; but the gun from which my illustration was drawn has the lock plates slightly bent, and the mainspring filed to fit them, which gives a "hand" much more elegant and pleasant to the eye. Indeed I have never before seen a cross-eyed gun stock which I could myself use with comfort from the left eye, but it is thereby brought nearer to the cheek; and, even with the extra half-inch in cast-off, unless the gun is held very strongly, with the left hand bearing against the bias to that side, an unpleasant blow will be given. To avoid the disadvantage attending on the plan, owing to the throw to the left, from the want of support in that direction, several expedients have been devised. Among these a very good shot, who has lost his right eye, and who writes in the *Field* under the signature "Monops," has recommended that two short cylinders shall be fixed either by solder or adjustable screw to the left of the barrels, in such a way that the line of sight thus obtained shall coincide at forty yards with that of the true barrel. This plan has been tried by several correspondents, but only one of them has succeeded in carrying it out successfully; and on the whole I should recommend the cross-eyed stock in preference, the main objection to it, viz., that it twists the gun from the true aim, not being so strong as that which is put forth against the projections from the barrels, that they catch against twigs and other obstacles in covert.

## SECTION VII.

### Choke-Boring and Regulating.

Although these processes are not usually carried out together, and in large factories are in the hands of different persons, it is well to consider them in relation to one another, inasmuch as they are both the final borings of the barrels chiefly carried out at their muzzles.

Commencing with choke-boring, to which I have already alluded in a cursory manner at p. 34. This process was first adopted by the public in America, where a trial, under the auspices of the *Turf, Field, and Farm* newspaper at New York in 1873, showed its superiority over the cylindrical barrel. Mr. W. W. Greener, of Birmingham, having entered guns there bored on the latter plan, was defeated by several firms using choke-bores, the winners being Messrs. W. and E. Scott, of Birmingham, who are large wholesale gunmakers there for the home and foreign market. Mr. Green, of Cheltenham, also competed, and was next to Messrs. Scott, while Mr. J. Rigby, of London and Dublin, and Mr. Dougall, of London and Glasgow, were present; and all came home deeply impressed with the value of the invention. All of these firms at once set to work to carry it out with more or less energy; but the defeated competitor, Mr. W. W. Greener, soon distanced his rivals, by advertising that he was prepared to supply 12-bore guns with a guaranteed pattern of from 210 to 220 pellets of No. 6 shot in the 30in. circle at 40 yards, and requesting me, as editor of the *Field,* to examine into and report on the truth or falsehood of his statements; but not being able to leave London, I contented myself, with noticing his offer in favourable terms.

This brought out in the following week (Dec. 12, 1874) the annexed letter from a Herefordshire gentleman of established reputation as an experienced shot:

SIR,—Your article in last week's *Field* on the "improvement" of breech-loaders by Mr. Greener, of Birmingham, in my estimation scarcely does justice to the gravity of the question. The "improvement" would have been better rendered by the word "revolution," for I do not hesitate to assert that it is a revolution as complete and, alas! as sad to those of us who thought we possessed the best guns that science and skill were ever likely to produce, as was the change from flint and steel to percussion (which I am old enough to remember), or from that again to breechloaders. It is with the hope of inducing brother sportsmen who are thinking of buying new guns to pause, and see the results of this change before they do so, that I now write.

My experience in guns and makers has been pretty wide, ranging from Old Joe Manton (my first love) down to the first makers of the present day. Two months since I thought I was the owner of guns second to none for pattern and hard hitting; the illusion has been rudely dispelled, as will be, I guarantee, those of thousands of others who think as I did. A few weeks back I received a circular from Mr. Greener, descriptive of the improvements he had made, accompanied by a note intimating that he had (I fancy by some new system of boring) attained pattern and penetration which would throw the performances of any gun I had into the shade. Of this I took no notice, but on going to the dog show I took with me a gun by one of the most eminent makers of the day, inwardly chuckling with a certainty of the result of any trial in its favour. The Greener selected was put into the scales, and proved to be a trifle under the weight of my own 7lb., both of 12-bore. The range was forty yards, the target 30in. diameter, the test first for pattern. Steadily, shot after shot, the Greener beat my gun by never less than sixty pellets, and with a regularity of pattern which astounded me. Nor was the trial for penetration less remarkable in its results. The target in that case was the ordinary *Field* pad of tough brown paper—thirty-six sheets. The Greener in every instance nearly put pellets through the whole thirty-six; the best performance of my gun was twenty-five. Reverting to pattern, I think, with the Greener gun, at forty yards it would have been almost impossible for a snipe to escape.

I omitted to say we were using No. 6 shot, the charge being 3drs. and $1\frac{1}{8}$ shot.

Whilst I was there, an entire stranger to me came to try a 10-bore he had just bought. I stayed to witness it. I did not inquire what charge was used; I only know that the 30in. target was literally smothered. I think it would have been difficult for even a humming-bird to escape.

I returned (in one sense) a sadder and poorer man to the extent of two new guns. EDWARD OTTO PARTRIDGE.

Easton Court, Herefordshire.

The publication of this statement created quite a sensation among shooting men, most of whom denied the possibility of the performance alleged to have been carried out; and in order to verify the statements of Mr. Greener and Mr. Partridge, I sent down a special commissioner to Birmingham, but not having himself loaded the cartridges, doubt was thrown upon his report, which had in the main supported the allegations of the two parties concerned. I determined, therefore, to repeat the experiments *in propria personâ,* having by agreement with Mr. Greener arranged to have them indorsed by the presence of Mr. J. Rigby, the well-known gunmaker, whose integrity and scientific attainments are generally admitted to be unimpeachable, and who was himself a competitor in the American trial. In the meantime Mr. W. Scott (one of the firm of W. and C. Scott) called upon me and asked for a similar trial of his guns, which Mr. Greener had publicly challenged to a renewed trial, and which, though choked, were bored on a somewhat different principle, and, he alleged, would perform with soft shot as well as Mr. W. W. Greener's with hard shot, at that time objected to by many sportsmen, for reasons which have long since been shown to be erroneous. In company with Mr J. Rigby, also approved of by Mr W. Scott, I proceeded to Birmingham, provided with an ample supply of Pettitt pads, made up in the usual way of 40 sheets of brown paper, and of Walker, Parker,

and Co.'s No. 6 soft shot. The result of this trial was reported by me. Premising that while Mr. W. W. Greener was fully prepared for and had challenged the trial, Mr. Scott had only a few days' notice of it, and had no stock of guns to select from, having sent out most of those made to his customers, but nevertheless he said he was ready to submit any guns in his possession to my examination and tests. Accordingly the respective trials took place at the private residences of the two competitors on Saturday, Jan. 23, 1875, and the report appeared in the *Field* of the following week as follows :—

Trial of Mr. W. W. Greener's Gun.

At eight o'clock on Saturday morning we met by appointment at Mr. Greener's works, and proceeded to load the cartridges with 3 drachms of powder each, and with shot, as follows, all being done before our eyes, as well as in the presence of Mr. Rigby: One dozen were loaded with 3 drachms No. 3 Pigou and Laurence's powder, and $1\frac{1}{8}$oz. of Walker's shot by measure, containing in round numbers 340 pellets, but really weighing fully $1\frac{1}{4}$oz., as the measure was heaped up; one dozen with No. 4 powder of the same firm, and $1\frac{1}{8}$oz. of Walker's shot; one dozen with No. 3 and $1\frac{1}{8}$oz. of chilled shot, containing about 330 pellets, measured by the same measure, and also weighing $1\frac{1}{4}$oz.; and one dozen with No. 4 powder and $1\frac{1}{8}$oz. of chilled shot. This and an inspection of the shooting gallery occupied us more than an hour, which delay, together with the drive, made it nearly eleven before we began to shoot the gun. The morning was damp and misty, but without wind until 12.30, when a slight breeze blew from the left front of the shooter; but this was cut off from the shot after the first few yards by a high garden wall, against which the target was placed. Measuring the distance and other preliminaries of course occupied some time, but we were able to devote two hours to the trial itself. As we promised, we took the pattern first from the centre of the pad, and afterwards from the centre of the best group, the circle in the latter case being made by Mr. W. W. Greener's assistant, and of course, when he was satisfied that no improvement could be effected, a second circle was not made, and the figures in that case coincide. After the second pair of trials with Walker's shot, Mr. W. W. Greener admitted that he could not reach the average he

obtains with the chilled shot, and to avoid waste of time he wished us to go on with the latter, which we proceeded to do, the result being as follows:

Trial of Mr. W. W. Greener's 12-bore gun, built for Mr. Partridge (weight 7lb. 3oz., laminated steel, 30in.), at 40 yards in the open.

| | Number of round. | Right Barrel. Pattern. Group from centre of pad. | Right Barrel. Pattern. Selected group. | Right Barrel. Penetration. | Left Barrel. Pattern. Group from centre of pad. | Left Barrel. Pattern. Selected group. | Left Barrel. Penetration. | Total of both barrels, pattern and penetration. |
|---|---|---|---|---|---|---|---|---|
| Two shots from each barrel, with 3drs. Laurence's No. 3 and 1⅛oz. Walker's London shot. | 1 | 163 | 177 | 25 | 174 | 181 | 27 | 747 |
| | 2 | 183 | 183 | 35 | 171 | 171 | 32 | 775 |
| | Average | 173 | 180 | 30 | 172½ | 176 | 29½ | 761 |
| Three shots with 3drs. of Laurence's No. 3 and 1⅛oz. chilled shot. | 1 | 208 | 208 | 37 | 89 | 98 | 29 | 669 |
| | 2 | 210 | 213 | 35 | 210 | 212 | 35 | 915 |
| | 3 | 185 | 185 | 34 | 108 | 108 | 32 | 652 |
| | Average | 201 | 202 | 35⅓ | 135⅔ | 139⅓ | 32 | 745⅓ |
| Two shots with 3drs. Laurence's No. 4 and 1⅛oz. chilled shot. | 1 | 239 | 239 | 29 | 208 | 208 | 33 | 956 |
| | 2 | 188 | 217 | 31 | 195 | 214 | 25 | 870 |
| | Average | 213½ | 228 | 30 | 201½ | 211 | 29 | 913 |

With his right barrel, in the first three shots, it will be seen that Mr. Greener got an average of 201 and 202, according to the two methods of striking the circle, but failed altogether with his left; and he was therefore induced to try No. 4 powder also with the chilled shot, in which both barrels showed better averages, the right showing an average of 213½ and 228, while the left was improved to the extent of 201½ and 211 respectively. Walker's shot had produced only an average penetration of 30 and 29½; but the chilled had reached 35⅓ in one series with the right barrel and in the other 30, while the left had produced 32 and 29. In one pair of shots, with No. 4 powder and chilled shot, Mr. Greener reached the high total of 956.

### Trial of Messrs. Scott's Gun.

Having now devoted the larger half of the day to Mr. W. Greener, we returned to Birmingham, and, at Messrs. Scott's works in

Lancaster-street, loaded four dozen cartridge cases (Eley's brown, like Mr. Greener's) with 3drs. and 3¼drs. Curtis and Harvey's No. 6 powder, and charges of shot similar to those of Mr. Greener, Walker's shot being from the same bag produced by ourselves, but the chilled shot being found by Messrs. Scott, and resembling in weight and number of pellets that used by Mr. Greener. We then had a seven-mile drive to Solihull, which we reached about three. By this time the weather had cleared and the wind dropped, what little there was being in favour of the gun. After measuring the ground, we began with Walker's shot, with which we had three pairs of trials, and then went on with the chilled shot. When these were duly recorded it was nearly dark, but we consented to take a few shots from a second unfinished gun, the shooting of which Mr. Scott said was doubtful, but which he wished to try. As it turned out, however, it was greatly inferior to the other gun, neither barrel giving a pattern so high as 160, and consequently it is needless to record its shooting more exactly. The following is the score of the first:—

**Trial of Messrs. W. and C. Scott and Son's 12-bore gun, No. 6511 (weight 7lb. 2oz., barrels 30in., Damascus), at 40 yards in the open.**

| | Number of round. | Right Barrel. | | | Left Barrel. | | | Total of both barrels, pattern and penetration. |
|---|---|---|---|---|---|---|---|---|
| | | Pattern. | | Penetration. | Pattern. | | Penetration. | |
| | | Group from centre of pad. | Selected group. | | Group from centre of pad. | Selected group. | | |
| Three shots from each barrel with 3 drs. C. and H.'s No. 6 and 1⅛oz. of Walker's London shot. | 1 | 104 | 150 | 39 | 208 | 216 | 30 | 747 |
| | 2 | 146 | 172 | 35 | 204 | 225 | 32 | 814 |
| | 3 | 115 | 137 | 34 | 230 | 239 | 37 | 792 |
| | Average. | 121⅔ | 153 | 36 | 214 | 226⅔ | 33 | 784⅓ |
| Three shots with C. and H.'s No. 6 and 1⅛oz. chilled shot. | 1 | 225 | 234 | 30 | 189 | 203 | 36 | 917 |
| | 2 | 157 | 170 | 31 | 174 | 187 | 35 | 754 |
| | 3 | 211 | 220 | 28 | 71 | 76 | 35 | 641 |
| | Average. | 197⅔ | 208 | 29⅔ | 144⅔ | 155⅓ | 35⅓ | 770⅔ |

From a comparison of the two tables it will be seen that with Walker's shot Messrs. Scott's gun showed a marked superiority over Mr. Greener's, both in average and in the highest score made. Indeed, with the left barrel, in his third shot, Mr. Scott got a

selected group pattern of 239, and a penetration of 37, equalling the highest pattern made by Mr. Greener, and exceeding the penetration of that particular shot by eight sheets. It is very remarkable that with Messrs. Scott's gun the averages made by the chilled shot are not so high as those of the Walker shot, so that clearly hardness is not an essential element of success in his principle of boring, though with Mr W. Greener's it seems to be necessary. The want of uniformity in the results obtained was displayed nearly to the same extent by each gun, and in each there was a marked superiority of one barrel to the other, which would not detract from the value of the gun in the opinion of many sportsmen, but which was not asserted to be intentional in either case. It may probably be attributed to atmospheric influences incidental to open shooting; and, from this cause, no doubt gallery trials are always more free from wild shots than those made in the field. With regard to recoil, we may mention that we ourselves tried both guns with the above charges, and found them shoot quite pleasantly, and rather below than above the usual "kick."

We cordially congratulate both Mr. Greener and Messrs. Scott on the result of their labours; and whether or no they can fairly claim any improvements upon the American system, they, and especially Mr Greener, are entitled to the thanks of English sportsmen for bringing it prominently forward. To us it appears clear that there is still room for improvement as to regularity and certainty of work, but we feel sure that in a very short time, now that notice has been drawn to it, there will be no difficulty in effecting it.

We are requested by Mr. Greener to state that he does not claim the invention of the new principle, and, that, although he considers that he has improved upon the American plan, his main claim is that he has been the first to bring it before the British public.

Mr. Greener not having been made aware of the nearly contemporaneous trial of Messrs. Scott's gun, which took place as soon after his as the distance (a few miles) between the two houses would admit, complained that I had concealed it from him, but here I confess that, in looking calmly back, I can see no ground for his charge. Messrs. Scott were really the parties who had most reason to complain, on account of the

want of sufficient notice; and all that could be said was said by myself in reference to the change of weather, which no doubt will sometimes affect the shooting prejudicially. Mr Greener, however, invited a further trial at his own range, open to Messrs. Scott, Rigby, Dougall, and himself, at forty and sixty yards, and to take place within a fortnight or thereabouts. Of course this challenge was not accepted, nor did I think it likely to be, as may be gathered from the editorial notice which I appended to it as follows: "We insert the above, but we have not the slightest idea that the challenge will be accepted. If any further trial is to take place, it should be on neutral ground, and with at least two months' notice. We beg leave to state that we informed Mr. Greener, on leaving him, that we were going to try another gun, and in justice to Messrs. Scott, we do not see how we could have refused to do so. We may also state that, in fairness to Messrs. Dougall and Rigby, we shall be happy to try their guns separately, on the same terms as those of Messrs. Greener and Scott, and report on them."

This somewhat unreasonable offer was responded to by Mr. Dougall, who had, however, to call in the guns to be tried from his customers, not having any in stock on which he could rely. Of course this was some disadvantage to him, but very pluckily he preferred submitting to this to a total abstinence from accepting the challenge. Mr. Rigby, on the other hand, decided on waiting till he could compete on equal terms.

### Trial of Mr. J. D. Dougall's Guns.

On Feb. 14 we tried four of Mr. Dougall's guns at Wimbledon, with the following results: The day was very favourable—dry, and almost without wind, what little there was being from the front. In compliance with his request, we used the same measure of shot as before, but "stricken," making the charge average $1\frac{1}{8}$oz. by weight, the variation not exceeding three or four pellets.

**Trial of four 12-bore guns built by Mr. Dougall. Three of them have been in use through the season just over. The fourth (No. 3410) is new. All Damascus barrels. Charges in each case 3drs. Curtis and Harvey's powder, No. 6, and 1$\frac{1}{8}$oz. Walker, Parker, and Co.'s No. 6 shot, furnished by us, averaging 265 pellets to the ounce. Whole charge about 300 pellets.**

| Guns. | Number of round. | Right Barrel. Pattern. Central group. | Right Barrel. Pattern. Selected group. | Right Barrel. Penetration. | Left Barrel. Pattern. Central group. | Left Barrel. Pattern. Selected group. | Left Barrel. Penetration. | Total of both barrels, pattern and penetration. |
|---|---|---|---|---|---|---|---|---|
| No. 3338. Weight, 7lb. 2oz.; length of barrels, 30in. | 1 | 196 | 204 | 40 | 189 | 189 | 40 | 858 |
| | 2 | 198 | 200 | 31 | 122 | 130 | 32 | 713 |
| | 3 | 72 | 87 | 30 | 191 | 201 | 39 | 620 |
| | Average | 155$\frac{1}{3}$ | 163$\frac{2}{3}$ | 33$\frac{2}{3}$ | 167$\frac{1}{3}$ | 173$\frac{1}{3}$ | 37 | 730$\frac{1}{3}$ |
| No. 3339. Weight, length, &c., as above. | 1 | 184 | 192 | 31 | 194 | 197 | 37 | 835 |
| | 2 | 154 | 175 | 36 | 157 | 157 | 37 | 716 |
| | 3 | 161 | 206 | 30 | 186 | 194 | 34 | 811 |
| | Average | 166$\frac{1}{3}$ | 191 | 32$\frac{1}{3}$ | 179 | 182$\frac{2}{3}$ | 36 | 787$\frac{1}{3}$ |
| No. 3410. Weight, 7lb. 2$\frac{1}{8}$oz.; length of barrels, 31$\frac{1}{8}$in. | 1 | 122 | 203 | 29 | 172 | 187 | 34 | 747 |
| | 2 | 117 | 129 | 33 | 158 | 167 | 29 | 633 |
| | 3 | 191 | 191 | 35 | 156 | 168 | 40 | 781 |
| | Average | 143 | 174$\frac{1}{3}$ | 32$\frac{1}{3}$ | 162 | 174 | 34$\frac{1}{3}$ | 720$\frac{1}{3}$ |
| No. 3366. Weight, 6lb. 15oz.; length of barrels, 30in. | 1 | 156 | 160 | 38 | 182 | 190 | 33 | 759 |
| | 2 | 138 | 169 | 35 | 168 | 186 | 37 | 733 |
| | 3 | 89 | 110 | 30 | 164 | 164 | 35 | 592 |
| | Average | 127$\frac{2}{3}$ | 146$\frac{1}{3}$ | 34$\frac{1}{3}$ | 171$\frac{1}{3}$ | 180 | 35 | 694$\frac{2}{3}$ |

In comparing the above scores with those made by the guns we recently tried at Birmingham, it will be seen that the patterns are considerably less—Mr Dougall's highest average being 182$\frac{2}{3}$, against Mr. Greener's 213$\frac{1}{2}$, and Messrs. Scott's 226$\frac{2}{3}$; but, on the other hand, his penetration exceeds theirs, three of his shots having pierced forty sheets (with five, two, and three pellets respectively), and his highest average being 37, against Messrs. Scott's 36, and Mr. Greener's 35$\frac{1}{2}$. The reduction of the charge of shot may probably account for these variations, but the result leaves no doubt on our mind that Mr. Dougall's system of boring is founded on the new American principle. Three of his guns had been used through the past season, in the hands of gentlemen to whom we are permitted

to refer, and bear evidence of moderate work externally. This will be satisfactory to those who wish to ascertain whether the new system will stand wear and tear.

These trials naturally led to an angry discussion, and to requests for a public competition, by which the disputed questions might be finally settled. Onerous as the task was, I at once consented to undertake it, and giving rather more than two months' notice, advertised one at which the proprietors of the *Field* offered a 40-guinea silver cup for the best choke-bore, and a 10-guinea cup for the best cylinder gun both 12-bores. In addition to this, 8-bores and 20-bores were also tried, but without any prizes being given. All expenses, amounting to several hundred pounds, were borne by the proprietors of the *Field*, and the competition was entirely free.

The result of this trial was that choked 12-bores were shown to have an increase of pattern (using No. 6 shot) of about 70 pellets in the 30-inch circle at 40 yards, while the penetration was increased about one-fifth. At page 53, an exact record of the performances of the best six guns in the cylinder and choke-bored classes is given, and also a comparison of these with the six best guns shot in the 1866 trial, where, moreover, the No. 6 shot had 280 pellets in the ounce, or about 12 in the charge of 1⅛oz. (used in both trials) above the sample used in 1875, which was 270 to the ounce. This result, of course, not only increased the reputation of the choke-bore as an improved principle for boring guns, but Mr. W. W. Greener winning in three out of the four classes against a great number of competitors, his guns were also brought prominently into notice. A trial at pigeons in 1876, carried out by the Gun Club, was not so successful, the cylinder aided by concentrators, which were permitted to be used, winning by 2 birds at 27 yards rise, and by 7 birds at 33 yards. The best shots were, however, on the side of the cylinders to which Messrs.

Purdey, Lancaster, Grant and Boss still adhered; and, as their guns were chiefly used at the pigeon matches held at Shepherd's Bush and Hurlingham, this might naturally be expected. In the following year, however, Mr. J. Purdey offered a 50-guinea silver cup to be shot for by the two kinds of boring, and here Mr. Greener, who had only one gun in it against fourteen by the best London makers, made the best score on the first day at 30 yards, his chance being committed to Mr. Cholmondeley Pennell, who at that time was handicapped behind two or three of the best pigeon shots of the year, and on that day the choke-bores were first by 4 birds. Next day at 40 yards, however, Mr. C. Pennell missing his first two birds, changed his Greener gun for one by Dougall and killed his next three, thus winning the cup from Captain Aubrey Patton (who also used a Dougall gun) by one bird. At 30 yards the total score was chokes 26, cylinders 28; at 40 yards, chokes 19, cylinders 13; the chokes thus winning at the two ranges combined by 4 birds. To settle the question still further at the same meeting, eighteen members were chosen who were to shoot at 3 birds each with the choke-bore at 28 yards, and afterwards with the cylinder, the chokes winning by 2 birds. The same gentlemen then shot under the same conditions at 35 yards, when the powers of the choke were unmistakably shown by killing 36 birds against 24. No cylinder at this distance succeeded in killing all its birds, while five accomplished the feat among the chokes.

Again, in the *Field* trials of 1878 and 1879, Mr. Greener came out first, the records being given at pages 56-57; but the former only was a trial of chokes *versus* cylinders, for that of 1879 was confined to chokes of three gauges. Lastly, in 1881 Mr. Greener won the 100-guinea silver cup at Hendon, but here all the competitors (13) used guns more or less choked. From these several public trials, as well as from the satisfaction afforded by them in private sport, and the

favourable report which I made of their performances on the moor of Mr J. R. Ll. Price, at Bala, choke-bores at once came into general use, both by game and pigeon shots, and Mr. Greener, having been the chief means of their introduction, has largely profited by his skill and energy.

It is by no means easy to decide who was the inventor of this system; but it is pretty clear that it was practised in America for some time prior to 1873, and that it was adopted by at least two English gunmakers (viz., Messrs. Scott and Mr. Green, of Cheltenham) soon enough for them to send guns alleged to be bored to a certain extent on this plan to the New York gun trial of 1873. That they were not, however, at all equal to those of Messrs. Scott and Greener, which I tried next year, is pretty clear, because the highest average pattern of Messrs. Scott's three guns at New York was only 132⅙, and that of Mr. Green's four guns 150½, Mr. Greener's highest of his five guns being 113⅘. Messrs Scott obtained the highest penetration as tested by brown paper, his best average being 38⅔ shots with three pellets. Mr. Green pierced 34⅛, and Mr Greener 34⅘.

In 1872 Mr A. L. Johnson advertised in America a plan by which he guaranteed that he could bore guns to put the whole charge in a 30-inch circle at 40 yards; and, no doubt, whether or no he could do exactly what he alleged, he was at that time in possession of the plan known as "choke-boring" to a certain extent. At first a steel nose of smaller bore than that of the barrel was screwed on to the outside of the muzzle, with a shoulder accurately fitted to it. The inside projection was then cut away by an expanding tool, and the plan answered in all respects except that occasionally the joint gave way, and the addition to the muzzle blew off. The next expedient was to swedge in the muzzle by a proper tool; but the swedged metal soon expanded again, and this plan also was given up in favour of a stouter muzzle not bored

throughout from behind with the ordinary bit, as already described, and finally choke-bored with an expanding tool, which is the process still adopted, the only improvement in principle being to leave a greater length of the original or smaller bore at the muzzle than was at first considered sufficient, the increase being from less than one-eighth to fully half an inch. It was alleged in 1875 that in a very short time the slight projection inwards wore away, and so no doubt it did, with the muzzles left as they were in the main trial of that year. Indeed, several competitors withdrew at the last moment, finding, while finally regulating their guns, that instead of improving they went off in their shooting. To meet this defect the choke was made considerably longer in the guns intended for the "wear-and-tear" trial which I instituted at the end of the main competition, and carried out soon afterwards, when the three guns tested, belonging to Mr. Greener, Mr. F. Baker, and Mr. Maleham, all stood well the severe trial to which they were put, and established their claim to be considered capable of bearing the work given to sporting guns in the field.

As soon as the new boring was brought forward in England as above described, Mr. W. R. Pape, of Newcastle, claimed to have invented it, and to have provisionally instituted a patent for it immediately after the gun trial of 1866, alleging as a reason for not completing his patent that he thought the pattern made by it was too close for game shooting. To settle the pretensions of the several claimants, Mr Lane published the following letter in the *Field* some time before the trial of 1875 :

Sir,—The late letters and articles in the *Field* relative to the extraordinary power of these guns having given rise to much discussion as to the origin of this boring, and there being great reason to doubt its being truly an American invention—for, although I believe Americans claim to have used it in 1870, and that it was not known here until about 1873, yet several respectable makers assert that it was in fact copied by them from

English-bored guns—I think some effort should be made to settle this question, so as to let the real inventor (or first user in this country) get the credit fairly due to him; and, the plan being no longer a trade secret, I am induced to offer, and will give, a prize cup (value 10*l.* 10*s.*) or the money to the English gunmaker who can satisfactorily prove either his being the original inventor or the first user in this country of the system; and I hope your committee on the approaching gun trials will kindly undertake to examine the evidence and award the prize.

I think this will prevent an injustice being done to the originator (whosoever he may be) of a highly valuable invention, and will be acceptable to all shooters.

I beg to append short rules for those intending to compete:

1st. All evidence to be documentary; patents, registrations, descriptive drawings, &c., to be verified in all important points by statutory declarations; or

2nd. Production of guns bored on the principle in the hands of gentlemen of undoubted respectability; certified by the owners as to date of make, and that they have not been re-bored or altered, and also by statutory declaration of the makers.

All evidence to be examined and prize awarded by the *Field* Gun Trial Committee, or by the Editor. In the event of any difficulty arising as to the boring or description of system, that Mr. Purdey, Mr. Lancaster, or some other magnate in the gun trade, not claiming, be requested to act as referee.

All papers to be sent into the *Field* office on or before the 26th day of April next, addressed to the Editor, and indorsed "Claim for prize for invention of new close-shooting system of boring shot guns."

ONE WHO HAS FIRED UPWARDS OF 20,000 TRIAL SHOTS AT MARKS.

This offer led to the following correspondence, which I insert at length as bearing upon several points of interest in the discussion.

SIR,—Seeing that a cup will be given the inventor of close-bored shot guns, I trust that the few pretended originals who have lately been overwhelming the trade by the power of their misrepresentations and humbug will not shirk the point, but be prepared to show why they have claimed my principle of choke-boring as inventions or improvements of their own, feeling as I

do that it is impossible to contend against such impudent and unprincipled pretensions, which can only be viewed with pain and shame by all respectable gunmakers. I should be sorry indeed if I claimed the invention of the principle which justly belongs to another; but, thinking I can clearly prove that this boring, which so many now claim, was invented and used by me years before it was ever known or thought of by any other maker in the trade, I now challenge Mr. Greener, Mr. Dougall, or any other maker, to cover the value of the cup already offered, and I will do the same, and, for the sake of truth and justice, let the inventor or he who can show best proof of originality, take the whole. Mr. Green, of Cheltenham, only claims to be the discoverer of the system; what is really meant by this is best known to himself, but my invention of choke-boring dates beyond the time he first sold a gun, or, indeed, before he was connected with the trade. I trust there will be no excuse or evasion of this proposal; if so, I shall leave it to sportsmen to draw their own inference from the fact. WILLIAM ROCHESTER PAPE.

Newcastle-on-Tyne, April 19.

SIR,—Mr. Pape, in your impression of last week, seems desirous, like Don Quixote, of tilting his lance against something or somebody, but, in doing so, does not imitate that knight of chivalry in the courtesy which graces all honourable encounter. In choosing this subject, he has selected, in my humble opinion, as his prototype did, the windmill, which, I believe, did not cease in continuing its evolutions and grinding its corn while the worthy Don was biting the dust. Also, it is expected that the barb of one's weapon should not be, like that of Laertes against Hamlet, primed with poison; and I therefore, before meeting Mr. Pape in any controversial contest, which he evidently seeks, beg to point out to him, and ask his explanation in a more intelligible form of, that part of his letter which I now quote; and I put into italics certain terms for his better notice and more comprehensible explanation, not only to us, but to all makers of close-bored guns. The passage is as follows:

"Seeing that a cup will be given *the inventor* of close-bored shot guns, I trust that the few *pretended originals* who have lately been overwhelming the trade by the power of their *misrepresentations* and *humbug* will not *shirk the point*, but be prepared to show why they have claimed *my principle* of choke-boring as inventions and

improvements of their own, feeling, as *I do*, that it is impossible to contend against such *impudent* and *unprincipled pretensions*, which can only be viewed with *pain and shame* by all *respectable* gunmakers."

I may as well take this opportunity of informing Mr. Pape that, had we known that he was the "inventor" and sole proprietor of this improvement we should "probably" have written to him for his permission, on a royalty, to use his system, and at the same time have asked him why he did not utilise its superiority of shooting in the *Field* trial of 1866, instead of adhering, as he then did, to the old boring, thus losing an opportunity—all in his own hands—of astonishing the world. Had we and others interested in this improvement done so, perhaps he would now have classed us without *pain and shame* amongst *respectable gunmakers.*

59, St. James's-street, April 26. J. D. DOUGALL, JUN.

SIR,—I must trust to your forbearance and sense of justice to allow me to occupy a brief space in your columns in answer to Mr. Pape's characteristic letter, which is in fact nothing more nor less than a direct personal attack upon me, though most people will of course notice the soundness of your foot-note, where you remind Mr. Pape that his letter is entirely superfluous, seeing that at that time a trial was pending.

Having been in the trade upwards of sixteen years, and as Mr. Pape claims a knowledge of choke-boring antecedent to that, it is more than singular that in competing in previous gun trials Mr. Pape has attained so low a shooting average, heading his competitors by only a few pellets; whereas, had he anything but the most rudimentary knowledge of what I understand as choke-boring, he must have distanced immensely guns which at that time were bored on the old system.

From Mr. Pape's advertisement in the *Field* some weeks ago, he admits that he had to discard the principle as useless, clearly showing that he had really not sufficient practical knowledge of the subject to make it of any value.

Now, with regard to Mr. Pape's proposal of another cup, as you have remarked, that would simply be a useless repetition of the present trial. What I should propose—nay, what I challenge Mr. Pape to do, is to shoot guns with me made previously to 1871, and which can be shown never to have been again re-bored; and, to make it more certain that the guns have not been re-bored

by either competitor, those guns should be chosen which have never been in the possession of the maker since their sale.

This I do, not so much to show who was the original inventor, but to show which has done the more to practically apply his knowledge. Should this meet Mr. Pape's view, I shall be pleased to make mutually satisfactory arrangements. E. C. GREEN.

87, High-street, Cheltenham.

SIR,—Mr. Dougall says he was unaware that I was the inventor and sole proprietor of the choke-boring, and asks why I did not utilise its superiority in the trials of 1866.

I beg to say that I did not consider it superior for sporting boring, nor do I now, as my letter in *Land and Water* of Feb. 27 will explain. The fact of my taking the first steps for patent protection for this boring the day after the 1866 trial is a full answer. Had I ever thought it worth while keeping my claim good by securing final completion of patent rights, Mr. Dougall would have found it requisite to have the permission of royalty.

May I ask Mr. Dougall why he also has not shown his extraordinary close shooting system in the recent trials? His average of three guns is only about equal to Mr. Davidson's sporting bored guns, as shot in class 3; therefore he has lost the same opportunity of astonishing the world in 1875 that I did in 1866. I hope he also has a reason for it. W. R. PAPE.

According to Mr. Lane's conditions Mr. Pape deposited his proofs, and they were duly considered by the committee composed of the following gentlemen, all of whom are admitted to be experienced sportsmen and excellent shots:—

COMMITTEE.

Colonel Goodlake, The Fishery, Denham, Buckinghamshire.
A. J. Lane, Esq., The Ferns, Surbiton, Surrey.
W. Lort, Esq., King's Norton, Worcestershire.
E. O. Partridge, Esq., Easton Court, Herefordshire.
I. E. B. Cox, Esq., Ivor House, Hendon, Middlesex.

After some time their award appeared as follows, and was published in the *Field*.

THE INVENTOR OF THE CHOKE-BORE.

AFTER carefully going through the claims of the several gun-makers sent in prior to the late trial, the Committee have awarded to Mr. Pape, of Newcastle, the prize offered by Mr. Lane. It appears that in May, 1866, Mr. Pape provisionally protected a new plan of boring guns, in which the muzzle was left one size smaller than the barrel, which was bored out up to within an inch of that part, and then gradually enlarged up to the muzzle itself. The patent was, however, not proceeded with, but the germ or principle of the boring now adopted is clearly there, though the proportions are different—and the results might not have been the same. The ten guineas have therefore been sent to Mr. Pape.

Now "one size" is rather an indefinite term, varying according to the gauge from 34-thousandths of an inch between 1 and 2-bores to 3-thousandths between 49 and 50 bores; but it may be here considered as applying to 12-bores, at which point in the scale the size is 19-thousandths, which, though not equal to the cut of a full choke, is about that of a modified choke, and (curiously enough) would not give the very close pattern which Mr. Pape adduces as the cause of his not prosecuting his invention. Mr. Green therefore has good reason for retorting on Mr. Pape in the letter quoted above, that he (Mr. Pape) having discarded "the principle as useless, clearly showed that he had really not sufficient practical knowledge of the subject to make it of any value." It is certainly very curious that a practical man like Mr. Pape, whose guns had always done well at the several trials, should never have brought his plan before the public until 1874, and that a gun of his which competed at New York in the 1873 trial, made the lowest pattern but one in the 10-bore class. In the 1875 trial, however (that is to say, only one year or a little more after Mr. Greener and Messrs. Scott exhibited their respective plans), he was able to run Mr. W. Greener hard, having three of his guns in the first six, one in his own name, and two in that of Mr. Davidson. Indeed, though he was beaten

for pattern, his penetration at 40 yards was 191, 194, and 171·5 against Mr. W. W. Greener's 188. The latter's pattern was, however, 214·5, while Mr. Pape only reached 176·7, 173·1, and 174·1, the extraordinary pattern aiding Mr. Greener in winning the much-coveted prize. It was alleged by Mr. Pape that he had secretly used the choke-bore prior to the 1866 trial, when, no doubt, he was superior to his antagonists; but the superiority was so slight as scarcely to bear out the allegation, for he only beat Mr. W. W. Greener by 6·3 in the figure of merit, the former scoring 279·5, and the latter 273·2, and their respective patterns being Mr. Pape 127·1, and Mr. Greener 121·4, neither of which was equal to Mr. Pape's performance at the 1859 *Field* Trial, where he averaged 138, though this no doubt was with 1¼oz. of shot, 290 pellets to the ounce. Nevertheless, it cannot be denied that the evidence in favour of Mr. Pape's claim is not to be disputed.

Having thus disposed of the above much-vexed question, I must now explain the exact nature of choke-boring as it was practised in 1875, when I first examined it with proper instruments, and as it is now generally carried out by the gun-making trade. Up to the above date Colonel Hawker's rule was that generally adopted, being founded on his examination and trial of guns built by Joe Manton, Egg, Wilkinson, and William Moore, all celebrated London gunmakers of the first quarter of the nineteenth century. To make his direction intelligible to the tyro, it should be understood that "relief" means a funnel-shaped muzzle and "opened behind;" a funnel-shaped breech, while "tight behind," means a contracted breech, or one with the funnel in the opposite direction. Most of his measurements are given as for punt guns, but one is for a 14-gauge as follows:

A common 14-gauge double gun (weight 8¼lb., barrels by Lancaster):

| | ft. | in. |
|---|---|---|
| Cylinder ... ... ... ... ... ... ... | 1 | 9 |
| Relief ... ... ... ... ... ... ... | — | 5 |
| Tight behind ... ... ... ... ... ... | — | 6 |
| Total ... ... ... ... | 2 | 8 |

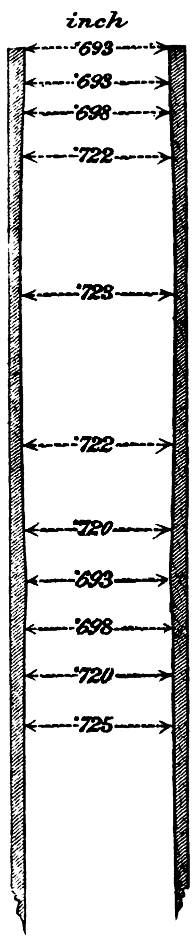
To this he appends the reason why a sporting gun should have its breech "tight behind," while a punt gun must be "open," namely, "because a sporting gun requires to be fired so many times in a day that we must adopt an inferior mode of getting friction, in order to prevent the barrel from becoming leaded, and therefore to make it shoot through the whole day nearly as well as when clean, and without recoil to the shoulder. Again, a sporting gun must of necessity be short, for the convenience of covert and snap shooting, and therefore the length that would properly suit that relief which must follow an opening behind (in order to prevent recoil, and preserve close shooting) would be generally objected to as an inconvenience." But these remarks were intended to apply to flint guns only; for he says, if detonators are "too tight behind, without any subsequent check, the powder would be blown away so quick as not to be half kindled." Since the time of Colonel Hawker the introduction of the breechloader completely did away with the necessity for lubrication, and consequently of the tightness behind; and, indeed, even before the invention became generally used in England, thick felt wads properly lubricated enabled the muzzleloader to go through a long day without becoming seriously foul. As a consequence the "tightness behind" was abandoned, and nearly all guns were more or less bored "open behind" and "relieved before." The opening was intended to confine the gas so as to increase the penetration of the shot, while the "relief" was supposed to concentrate the shot, and thus increase the pattern; but on what principle it acted was never satisfactorily shown.

The annexed figure will give an idea of this boring, but the amount of opening and relief are of course magnified. That relief was not necessary to good shooting is proved by the 1875 trials, at which the six best cylinder guns were carefully examined by me, and several of them were found to be true cylinders for at least ten inches, though giving as close a pattern as could then be produced by any boring but the choke. Since that time Mr. Baker and Mr. Powell have succeeded, to my knowledge, in slightly increasing the pattern without relieving the cylinder at all, but what they did beyond ten inches from the muzzle I cannot pretend to say. I have also examined many guns undoubtedly made by London gunmakers, and notably by the late Mr. C. Lancaster, in which the barrel for about one inch and a quarter was cut in circular grooves, which is called "ring boring," and was consequently within the usual definition of "choke boring," viz., "a plan in which the muzzle is smaller than any other part of the bore down to the breech end." These guns shot well both in pattern and penetration, but could not compete with a choke-bore. Still, under the conditions of the various trials in which I was concerned, I was obliged to reject them, although proved to be built before 1873.

TUBE SHOWING DIFFERENT BORINGS.

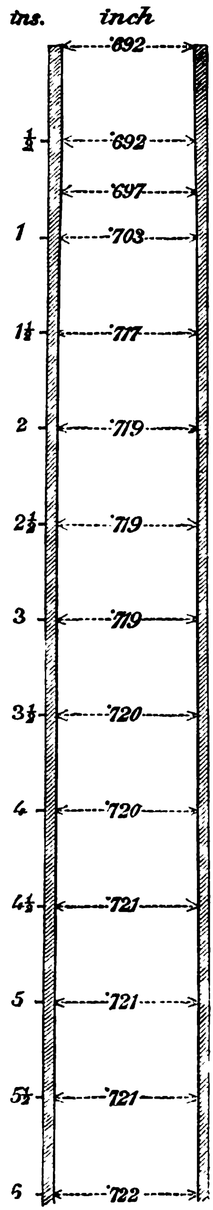
I now come to the exact nature of the choke-bore. In America, until after the 1875 English trial, the almost universal plan was to bore the barrel to within three inches of the muzzle a 12-bore, leaving the last three inches about a 14-bore or rather larger. An expanding bit was then introduced, which cut out a hollow or recess about two and a half inches long and from twenty-five to

thirty-thousandths of an inch deep, leaving a portion of the 14-bore about one-eighth inch long untouched at the muzzle. The bit was also introduced behind the original shoulder, which it bevelled off, leaving the barrel cylindrical up to within three inches of the muzzle, where there was an inclined plane to the original 14-gauge. The boring thus effected was patented by an American of the name of Faburn, and called the "recess," "jug," or "tulip" choke, which will be better understood on examining the engraving, in which the exact measurements are given in thousandths of an inch. Most of the guns competing at the 1875 trial were bored on this plan; but two or three adopted a different one, more or less resembling that selected by Mr. W. W. Greener. I was permitted in confidence by all the competitors to examine their guns in any way that I liked, on condition that I did not reveal their secrets; so that I am not justified in being more explicit. It was then, however, well known that Mr. Greener's method of choking was very different from that of Messrs. Scott, who followed the American fashion of recess choke. Mr. Greener's success naturally led to his plan being copied, which, of course, is easily done by anyone possessing himself of one of his guns and a proper measuring tool, which was soon offered by Mr. Allport, of Birmingham, and which will give the measurements all down the barrel to the thousandth of an inch. The plan of Mr. Greener's choke is shown in the annexed engraving in



TULIP OR RECESS BORING.

principle, though the actual measurements are not taken from one of his guns. According to his own description, published in both of his books, his choke is all given within about two inches of the muzzle, and the remainder of the bore is a true cylinder from the breech; but I certainly have never yet met with any gun, either of his or any other make, which would bear out his statement. As far as my knowledge goes, nearly all gunmakers now adopt a choke, tapering from about ·729 at the breech to about ·717 at one inch and a half from the muzzle, where a sharper contraction commences and progresses to a point half an inch from the muzzle, beyond which there is a true cylinder to the extreme end, with a diameter in a gun of the above dimensions of about ·692 inch. These measurements I have set out on the engraving; but in detail every gunmaker follows his own fancy, and the variations are indefinite.




THE LONG CHOKE (GREENER'S).

## SECTION VII.

### The Lock.

The modern lock in all cases consists of a mechanical arrangement by which a blow is given to the cap causing a detonation of its contents which is communicated to the gunpowder contained

in the cartridge case. In the early days of the breechloader a needle was sometimes made to perforate an explosive compound, which was fired by friction; but the detonating cap is now universally employed, requiring a sharp blow, and not a push, which sufficed for the needle-gun.

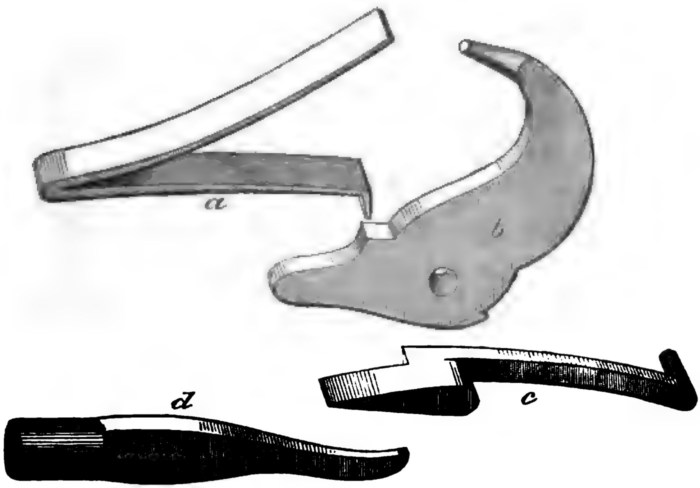
There are mainly two forms of lock now in use, (1) that on the principle of the old flint gun, by which a double lever is acted on by a flat spring, attached either directly or through a swivel to its lower limb, while its upper limb is driven forward, when the spring is allowed to act on pulling the trigger; (2) that form in which a straight striker, having a shoulder near its front end, is driven forward on the cap by a spiral spring coil round it, and acting on the shoulder above mentioned. A third, or compound, form has been patented by Mr. Grant, of St. James's-street, in which the spiral spring and rod are substituted for the flat spring; but instead of the rod passing straight forward to the cap, it acts on the arm of a double lever, which is hung in the same way as in the old-fashioned lock.

The first of these three forms is used in hammered as well as hammerless guns, the last two being confined to the latter.

The flat mainspring lock is made in three forms: (*a*) with the mainspring in front of the tumbler, as in the "bar lock" (so called because it was when first introduced fitted closely up to a bar on the side of the breech of the barrel), the Anson and Deeley, and other hammerless guns; (*b*) the back-actioned lock, in which the mainspring is behind the tumbler, and is let into the hand of the stock; and (*c*) a modification made in each of these, in which the mainspring is so balanced that after the blow the hammer comes back from the cap or striker about one-eighth of an inch, and the mainspring is then at rest, so that the cap cannot be exploded except by an outside blow on the back of the hammer. This last is known as the "rebounding lock," and is now almost always used in

hammered guns, and also in some hammerless guns, notably those of Messrs. Purdey and C. Lancaster.

(*a*) Although much more modern than the "bar lock," the Anson and Deeley, being simpler in its construction, may be described as the type of this form. Independently of the various screws or "pins," as they are called in the trade, and on which it works, it consists of three pieces only: (*a*) the mainspring, (*b*) the tumbler and striker combined, and (*c*) the scear, which fits into the notch or bent at the back of

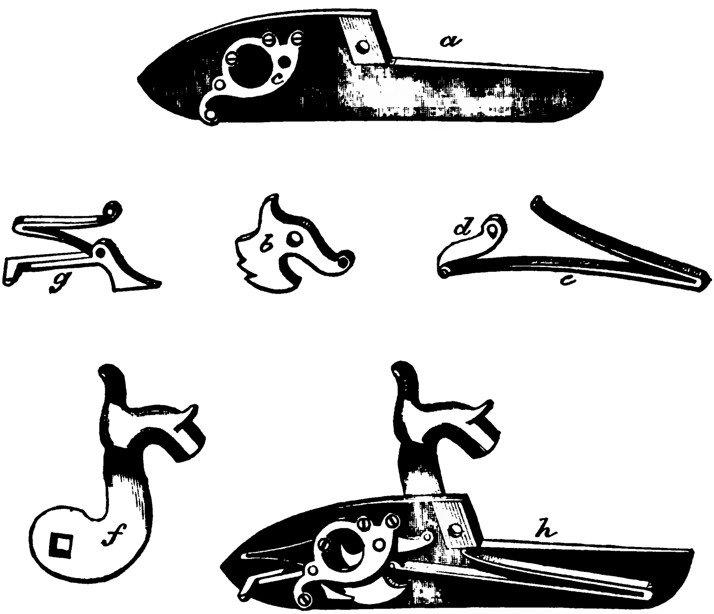



LIMB OF ANSON AND DEELEY LOCK (without scear spring and pins).

the tumbler, and keeps it at full cock, being maintained in its position by a small spring called the scear spring. These several parts are not mounted on a lock plate as in the old days, but are let into slots cut in the action, in which they are retained by screws or "pins." It will be seen that there is no swivel and hook between the mainspring and its bearing on the tumbler, and this no doubt in itself is an objection; but the parts are very strong, and work well enough for the purpose they have to fulfil. The tumbler has a prolongation forwards, by which it is lifted to full cock by means of one

end of a double lever (*d*), the other end of which is acted on by the fall of the barrels; but this last is an addition to, not a part of, the lock, and is rendered necessary only in hammerless guns in which the cocking cannot be done by the hand.

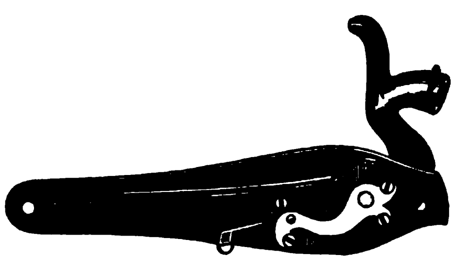
In the bar-lock of the hammered gun a swivel (*d*) is introduced between the spring (*e*) and the tumbler (*b*), by




Bar Lock—Hammered Gun.

which the spring is made to increase its force instead of diminishing as all springs naturally do when they are relieved. Instead also of the striker being concealed it is a separate limb (*f*) fixed outside the lock plate (*a*) on a square which forms a part of the tumbler, and it is usually called the hammer. The tumbler (*b*) works between the lock-plate (which is let into the stock and action), and an open iron bridge called the bridle (*c*), the latter being intended

to steady the hammer as it falls with considerable force to explode the cap. This requires that the hammer shall be raised and the spring thereby compressed by means of the thumb bearing on it, and in order to maintain it in this position a catch called the scear (*g*) is introduced (also between the bridle and lock-plate) the nose of which drops into one or other of the two notches or "bents" in the tumbler. One of these is much deeper than the other, so deep indeed that when the nose of the scear is in it no pressure put on its posterior limb will release it. If, therefore, the hammer is only raised thus far (called half-cock) it cannot be discharged by pulling the trigger, because the latter bearing on the scear has no power to release the tumbler. A more shallow bent will be seen above the deep one, and by pulling the hammer further up the scear drops into it (called full-cock), and then the trigger can be pulled, the force required varying with the depth of the bent from about half a pound, which is highly dangerous, to seven or eight pounds, which is unpleasant, the usual "pull" being about four pounds. These several "limbs," as held together by their various screws ("pins"), are also shown at half-cock.

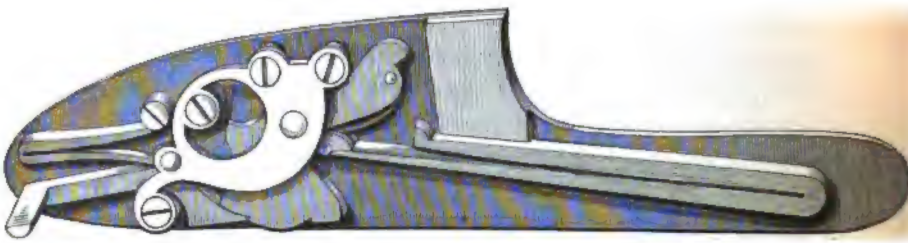


BACK-ACTIONED LOCK OF THE HAMMERED GUN (half size).

(*b*) The back-actioned lock consists of the same parts as the bar-lock, but instead of the spring being in front it is placed behind, and the plate with its limb is let into the hand of

the gun. By reference to the engraving the alteration will be readily understood.

(c) The rebounding lock was introduced in 1869 by Mr. Stanton, of Wolverhampton, and very speedily came into general use. A similar principle had previously been invented by Messrs. Bardell and Powell, of Birmingham, but in their form the rebound is caused by the scear spring, while in Mr. Stanton's the short limb of the mainspring effects it in the following manner: By comparing the rebounding lock with the ordinary bar lock at page 128, it will be seen that in Mr. Stanton's, instead of the short limb of the spring bearing dead on a lump in the plate, it is prolonged back-



STANTON'S REBOUNDING LOCK, COCKED (full size).

wards until it reaches the crane of the tumbler, which has a notch cut in it to receive the end of the spring. When the trigger is pulled, and just before the striker can reach the cap, this notch falls on the spring, which, by the impetus of the blow, gives way to allow the cap to be reached and broken. As soon, however, as this has taken place, and the force of the impetus is exhausted, the short limb of the spring returns the striker to its original position at about one-eighth of an inch from the cap, and there it remains virtually at half-cock, though without any bearing of the scear on the half-cock bent. Its position is in fact caused by the two limbs of the spring balancing it there, their relative strength being regulated accordingly. By

this arrangement after firing, the gun is, as it were, always returned to half-cock. In the engraving the tumbler is shown at full-cock, but it may be readily seen that, when the trigger is pulled, the notch in the crane of the tumbler would fall on the end of the short limb of the spring.

With this lock after the gun is fired, and without raising the hammer to half-cock, the action can be opened and closed, because the strikers are free, and readily retire from the face of the false breech, either by the spring, which is sometimes used, or by the pressure of the barrels, as they pass them.

The spiral spring lock was first used in the Prussian needle-gun; but Mr. Needham, of London, soon introduced it into his sporting gun with considerable improvements, and of late years the Martini military rifle has been dependent on it. In all cases it simply consists of a spiral spring acting on a rod with a shoulder to it, the rod being provided with a bent and scear on the same principle as that of the ordinary flat spring lock. When there is sufficient space for a moderately long spring this form acts reasonably well, but in a cramped space, as in the Martini lock, there is not sufficient play, and the effect is radically bad. In any case, in common with most experienced sportsmen, I greatly prefer the flat spring. In nearly all locks but the Anson and Deeley, the tumbler does not itself strike the cap, but falls on a small shouldered rod inserted in the break-off, whether the gun is hammered or hammerless. This rod is sometimes provided with a spring, which brings it back after the blow of the tumbler; but generally, and notably where the rebounding lock is used, no such provision is made, and the rod is left to be pushed back by the opening of the action.

The combination of the two forms of lock used by Mr. Grant will be better described when alluding to his gun in its totality. In the muzzleloader and hammered breechloader (except rifles) reliance is usually placed for safety on the

half-cock or rebound; but in hammerless guns, which in nearly every case must be loaded at full-cock, something more is required in the nature of what is usually called a safety bolt, which I shall now proceed to describe.

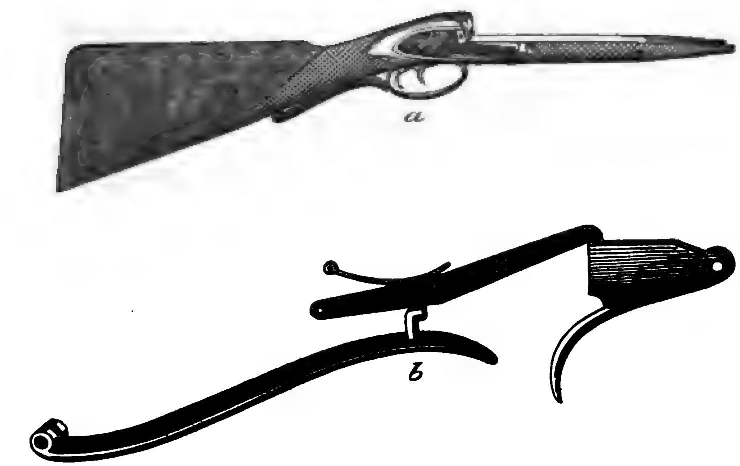
## SECTION VIII.

### Safety Bolts.

Prior to the invention of the Lefaucheux gun the only danger of an accidental explosion lay in a pull of the trigger from carelessness on the part of the shooter, in passing through a hedge or in covert with his gun at full-cock. No one dreamt of loading at full-cock; and, indeed, when both barrels had been fired, no time would thereby have been saved, because it was just as easy to cock after loading as before, and consequently no time was lost by doing so. To obviate the danger from carelessness several plans were invented, the triggers in some being always bolted except when the hand grasped the stock, and in others only when the gun was perpendicular, as in the position for loading, a weighted lever let into the stock applying the bolt to the trigger. The former of these plans was supposed to provide against explosion during loading, after firing one barrel, the other being carelessly left at full-cock; but it was found by experience that no reliance could be placed on it, for the jar of the ramrod in seating the wads sometimes released the scear from the bent although the triggers were bolted, and as a consequence sportsmen invariably let the hammer left at full-cock after firing one barrel down to half-cock before loading. The only safety guard at all generally used was that invented by the celebrated Joe Manton not long before his death, and afterwards recommended to his customers by that good sportsman Mr. Lang, of Cockspur-street, who always used it in the

field. It consisted of a lever under the hand (see *a*), which dropped about a quarter of an inch when not grasped, and in that position set at liberty a short hook, which was then pressed down by a spring into a notch cut in the top of the trigger (see *b*). Those who had become accustomed to this guard were warm its favour, but it never got into very general use.

On the invention and introduction of the Lefaucheux gun, the danger of an explosion during loading was in a great




JOE MANTON SAFETY GUARD.

measure done away with, except in loading after firing a single barrel, the other being at full-cock, but sportsmen had been so accustomed with the muzzleloader to let down the hammer of the second barrel to half-cock, that they continued to do so as a rule after they had adopted the new gun. Moreover, at that time, the breech was closed without much force, the grip action requiring the lever to be pushed home by the hand, and the danger of a jar out of the bent being comparatively small. But then came the snap action, and finally the hammerless gun, which is of necessity loaded at full-cock, when

the danger became so great that I was induced to warn the readers of the *Field* against it. This was in the year 1879, at which time the Anson and Deeley lock was in full command of the market, and provided only with a safety bolt, which was so little reliable that it was withdrawn from use, and the customers of the great Birmingham firm, which adopted it, were advised to dispense with a safety bolt altogether. The bolt in question was correct in principle according to my ideas; that is to say, it provided against the effect of the jarring of the scear out of the bent, by placing an intercepting bolt ready to receive the blow of the striker, and in that way guard the cap, but unfortunately it was so constructed that if the trigger was pulled when this bolt was at "safety," and before re-cocking the gun the safety bolt was let down to "firing," an explosion would generally take place to the great danger of any bystander who might be in front of the gun. Since that time the lock has been guarded in various ways, the trigger being also protected from a careless pull by a lever being automatically pressed down on them until removed by the finger. But when I took up the subject, the Anson and Deeley and various other hammerless guns were in constant use without any protection whatever, and many accidents and narrow escapes were publicly recorded, while a greater number were concealed. To obviate this danger, it occurred to me that I might adopt an action which I had exhibited in 1866 (in which outside hammers were cocked by the fall of the barrels) to the hammerless lock, and at the same time make the same movement raise an intercepting block bolt to take the blow in case of a jar. Accordingly I constructed a model gun on that principle, which I exhibited to the trade for their approval, and which was carried out by several firms with more or less ingenuity, notably by Messrs. Bland and Sons, of Birmingham and London, and by Mr. Green, of Cheltenham; but, though simple enough in principle, it was very expensive

in construction, and as a natural consequence it was not generally adopted. Moreover, although it was free from the defect alluded to as attaching to the Anson and Deeley bolt, it did not provide against the delay occasioned by the pull of the trigger with the bolt at "safety," after which the action must be opened in order to re-cock the gun. Although, therefore, in point of principle, the gun is an exceedingly good one, its prime cost militated so much against its use that it could not compete in the market with those which could be made at half its price. Still I may lay claim to the merit of having opened the eyes of the public to the danger they were incurring, and of having thereby forced the gunmakers into providing against them, for since that time excellent safety bolts have been devised, on various principles, including modifications of the Anson and Deeley, by Powell and Son; Messrs. Scott's most ingenious bolt, which is always in action till the trigger is pulled; that of Messrs. Silver, on the same lines as the Joe Manton safety bolt above-mentioned; Messrs. Rigby's and Bissell's bolt, and some others which will be referred to more minutely when examining the several guns in which they are adopted.

Having thus given a short history of the "safety bolt," I may now lay down the conditions which I think in all cases should be fulfilled in order to make it a reality and not a sham.

First, In all cases the bolts should be automatic; that is to say, the act of opening the gun for the purpose of loading should place the bolts at safety.

Secondly, There should be two separate bolts—one placing an intercepting block before the striker, and the other bolting the triggers. Both of these should be automatic.

Thirdly, In all cases the trigger bolt should be easily let down to firing, and, except in the case of Messrs. Scott's and Messrs. Silver's intercepting bolts, the block bolt also. In the

two bolts above mentioned it is not necessary, because, in the one case, the fall of the trigger lowers the bolt, and in the other, the grasp of the "hand," so that with them it is always in action till the moment of firing the gun.

Unless the above conditions are in force no hammerless gun can, in my opinion, be considered as otherwise than unsafe. With them I regard it as more free from danger than any hammered gun, not even excepting those provided with the rebounding lock. It is quite true that this latter is free from the danger of explosion caused by a jar in loading, except in the case of one barrel being left at full-cock; but when the lock is worn the hammer may be raised from the rebound nearly to full-cock by means of a twig, and in that way an explosion may be caused. This will not occur in a new and well-filed lock, because, unless the trigger is pressed, the scear generally drops into the half-bent during the fall; but I have tried the experiment in numberless guns and find that it does occasionally happen.

An accident is recorded in Mr. Greener's recent book on "The Gun," which shows, in the first place, the necessity of something more than a trigger guard; and, secondly, the curious mistakes made even by the most experienced gunmakers in giving their opinions. At page 366 he says: "Whilst grouse shooting a gentleman left his gun leaning against a rock, muzzle upwards, and went to luncheon, which was spread at a distance of nearly forty yards from the gun. Unfortunately, a dog knocked over the gun, and the charge of shot reached the party with so great a force as to badly wound the owner of the gun and entirely destroy the sight of one eye." Now, the discharge was manifestly caused by the fall jarring the scear out of the bent, for, of course, the dog did not pull the trigger; and this shows the importance of the intercepting block, which, if present, would have prevented the explosion. But, then, Mr. Greener goes on to

remark: "With our butt-safety this accident could not have occurred, as the gun would have bolted itself in the act of falling." Yet Mr. Greener's "butt safety bolt," described at page 365 of his book with an engraving, and to which he refers, only bolts the triggers, and would have no effect whatever in preventing the jar of the scear out of the bent. If, therefore, the gun in question had been provided with it the accident would not have been prevented, although the trigger might have been bolted in the act of falling. Mr. Greener nevertheless states that "by this simple contrivance the weapon is quite safe unless placed to the shoulder or *butt downwards on the ground.*"

## SECTION IX.

### Gun Furniture.

The furniture of a gun consists of (*a*) the trigger plate, and trigger or triggers; (*b*) the guard which is attached to the plate; and (*c*) the heel plate to the stock, which, however, is often omitted. In first-class guns these are made of best iron, but in cheap ones they are often only of malleable iron. The filing of these parts is a separate trade.

(*a*) The trigger plate in nearly all modern breechloaders, and specially in hammerless guns, is firmly jointed and screwed to the action, and adds greatly to the strength of the "hand." Great skill is required to pitch the triggers well, so that they bear with full force on the scears, and leave sufficient space for the fingers to act independently. A fine spring is used either to keep them to or from their work as may be desired, the latter being sometimes necessary from the peculiar construction of some particular lock.

(*b*) The guard is in all cases a bow of thin iron fixed under the triggers to protect them from accidental pressure, and yet allow the fingers to be readily applied.

(*c*) The heel plate in the days of muzzleloaders was made of iron to protect the stock from injury in loading. It is now generally made of horn or altogether omitted, by which the extra weight of metal is avoided.

## SECTION X.

### The Fore End.

In nearly all the modifications of the Lefaucheux gun the barrels are removed from the stock at the hinge, which is cut in half for that purpose, one moiety being part of the lump, the other being removable at will. This movable part is called the "fore end," and is composed of iron and walnut wood, the former completing the joint, and inserted in the wood for the sake of lightness and facility of grasp by the left hand. In the original gun the fore end was attached to the barrels by a loop and slide resembling those of the muzzle-loader; but various devices are now employed to facilitate the removal, and do away with the necessity of a tool by which the slide was withdrawn. In the form most generally used the fore end keeps its place by virtue of a slight hook, which is really sufficient for all practical purposes, and is released by simply lifting the horn tip at the end of the wood from the barrels.

## SECTION XI.

### Engraving.

Very expensive engraving was in fashion some years ago, costing from 5*l.* to 10*l.* a gun, but most sportsmen now prefer either a perfectly plain gun, or one with very little ornamentation.

## SECTION XII.

### Case Hardening.

To increase the hardness of the wearing surfaces where steel is not employed a process is adopted which is called by the above name. It is applied to the lock, furniture, &c., which are taken to pieces and placed in an iron box, together with a quantity of animal charcoal. The whole is then placed in a furnace, and submitted to a certain heat, after which they are allowed to cool, when the bright metal surface is found to have acquired a peculiar mottled appearance made up of blue and a dull grey, and a hard skin is formed without making the iron brittle.

## SECTION XIII.

### Browning.

In order to show the composition of the twisted barrel when composed of iron and steel, a process is adopted by which the different action of acid on the two metals is displayed. For this purpose the following mixture is employed :

| | |
|---|---|
| Muriated tincture of iron ... ... ... | $\frac{3}{4}$oz. to 1oz. |
| Nitric acid ... ... ... ... ... ... | $\frac{1}{4}$oz. |
| Corrosive sublimate ... ... ... ... | $\frac{1}{4}$oz. |
| Sulphate of copper ... ... ... ... | $\frac{1}{8}$oz. |
| Spirit of wine ... ... ... ... ... | 1oz. |
| Water ... ... ... ... ... ... ... | 1 quart. |

Mix and keep for at least a month.

Carefully remove all grease by friction with lime, then apply the above with a sponge every two or three hours,

scratching the rust off with a steel wire brush night and morning until the desired colour is obtained. The acid is then removed by pouring boiling water on, and the polish is given by gentle friction with leather. It requires, however, great practice to make the barrels lock well.

# CHAPTER V.

## THE MUZZLELOADER.

THE breechloading system has now so completely superseded the muzzleloader that the latter has become an absolute rarity in the hands of a sportsman, and can scarcely find a customer at any price in this country. It is useless, therefore, to describe it in a book treating of modern guns.

For many years, however, its advocates regarded it as superior in strength of shooting to the breechloader, and so no doubt it was in the early days of the latter arm; but this has within the last ten years been brought to such perfection, that the muzzleloader is beaten at all points. It can, however, still be produced at less price, and for the foreign market it holds its own, being made up as low as 7*s.* 6*d.* a gun, chiefly for the African trade.

# CHAPTER VI.

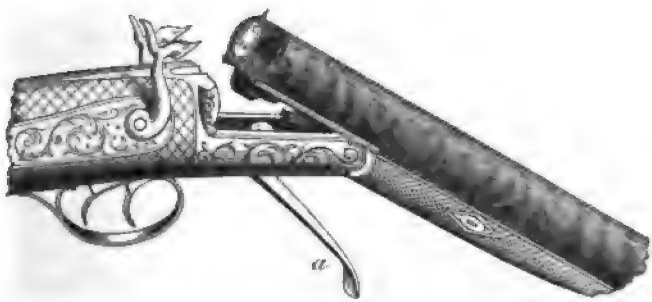
## THE HAMMERED BREECHLOADER.

### SECTION I.

#### The Original Lefaucheux Gun.

Until about the middle of the present century sportsmen throughout Europe were contented with the detonating muzzleloader which had been invented and brought to such perfection as to supersede the flint gun soon after the year 1818, when the copper cap was first introduced. The celebrated Colonel Hawker claims the merit of having given the first idea of the perforated nipple to Joe Manton, but it is now impossible to decide the question as to the real inventor of this system. Previous to its adoption sundry expedients had been devised, by which fulminating powder might be made to supersede the flint and steel for the purpose of ignition, by means of pellets, tubes, &c.; but when once the nipple had been suggested it speedily beat all its rivals out of the field. So also with the Lefaucheux breechloader—patented in France about thirty years ago. Up to that time numberless inventions had been brought out for loading at the breech, but all had failed because it was found impossible to stop the leakage of gas. Metal cases had been tried in the form now used, but it had been found that they could not be extracted, the present plan of bringing them out by a special automatic tool not having been devised. At length Lefaucheux thought that a case made of brass and paper would answer the purpose, and at the same time constructed

a gun with the barrels hinged in a peculiar way, so that their open breeches might be readily exposed for the introduction of the cartridge. Lastly, he placed a small percussion cap in the middle of the base of this cartridge, and passed a brass pin through the side to reach it, thus enabling it to be exploded by the blow of the hammer, and at the same time affording a means of withdrawing the empty case by the aid of the fingers laying hold of the pin, supplemented, if necessary, by a little tool. Such was the simple form in which this invention, the germ of all our modern improvements, was introduced into this country a quarter of a century ago




ORIGINAL LEFAUCHEUX ACTION.

by Mr. Lang, of Cockspur-street, in which the Lefaucheux gun is shown open, with one pin cartridge in its place, the other being withdrawn. In this form a single hook kept down the barrels, being moved into its slot cut in the lump by a turn of the lever *a*, and hence called the single grip.

## SECTION II.

### BREECHLOADERS v. MUZZLELOADERS.

Mr. Lang was so well known both as a sportsman and a gunmaker that the invention speedily took root in this

country, but it was at first met by the assertion that it could not compete in shooting power with the muzzleloader. An angry correspondence went on for some time in the *Field* on this subject, and, to settle the matter, I set on foot the first public gun trial ever held in this country, which took place at Ashburnham House in 1858, the muzzleloader beating its rival at all points. In the following year I organised another at Hornsey Wood House, then the fashionable pigeon ground, and had twenty-nine entries, three muzzleloaders being again first, second, and third, but very hard pressed by the breechloaders, as will appear from the following table:

| | Kind of Gun, all 12-bores. | Powder. | Shot. | Pattern. | | Penetration. | | Weight of Gun. |
|---|---|---|---|---|---|---|---|---|
| | | | | Right. | Left. | Right. | Left. | |
| Pape............ | Muzzleloader. | 2¾drs. | 1¼oz. | 158 | 118 | 28 | 33 | 6lb. 11oz. |
| Prince & Green | Ditto. | Ditto. | Ditto. | 148 | 98 | 28 | 22 | 6lb. |
| Pape............ | Ditto. | Ditto. | Ditto. | 116 | 129 | 25 | 28 | 6lb. 8oz. |
| Egan ......... | Breechloader. | 3drs. | Ditto. | 144 | 90 | 28 | 30 | 7lb. 8oz. |
| Prince & Green | Ditto. | Ditto. | Ditto. | 103 | 93 | 24 | 31 | 7lb. 2oz. |
| Pape............ | Ditto. | Ditto. | Ditto. | 132 | 93 | 26 | 33 | 7lb. |

The result of this trial raised the new gun nearly to a level with its established rival, while its superior handiness in point of loading maintained its claim on the attention of the sportsman so fully that Mr. Lang's business rapidly increased.

## SECTION III.

### The Double Grip.

But it was soon found that the single action would not stand much work, and a single season's hard shooting wore away the tooth of the single grip, so that the action became loose, though still safe. To remedy this defect a second tooth was

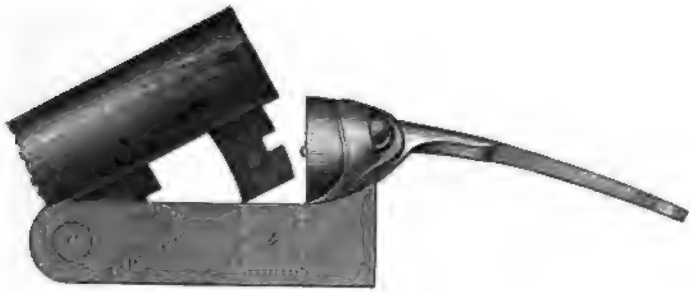


Fig. 1. Purdey Bolt Action (half size).

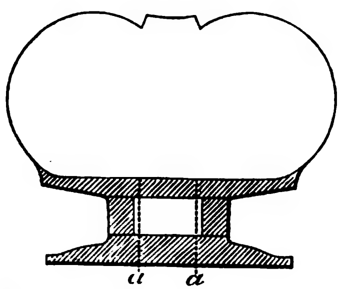



Fig. 2. Section of the Body of Purdey Bolt Action (reduced one-third, shewing width of lump *a a*).

Fig. 4. Back View of Double Grip (full size).

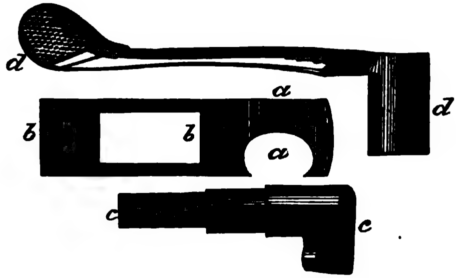



Fig. 3. Plan of Purdey Bolt (reduced one-third; *a a* slot for cam *c*; *b b* wearing surfaces; *d d* top lever).

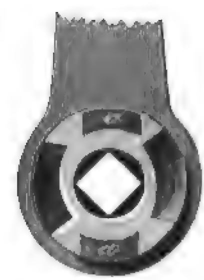


Fig. 5. Plan of Double Grip (full size, shewing wearing surfaces *a a*).

DOUBLE GRIP CONTRASTED WITH PURDEY BOLT.

*Face page* 144

added, and so constructed that the gun would partially snap on closing it, but it still required the pressure of the hand on the lever to complete the fastening. This was called the double-grip action, and it has maintained its ground to the present day as one of the strongest of all those known to gunmakers, though, for general shooting, superseded by the snap bolts of Westley Richards, Greener, and Purdey.

## SECTION IV.

### The late C. Lancaster's Gun.

But there was still a weak point in the new gun. The cases sometimes stuck so fast that the pin failed to extract

Fig. 1.

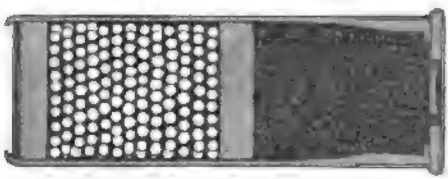
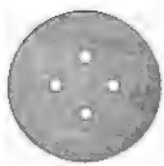


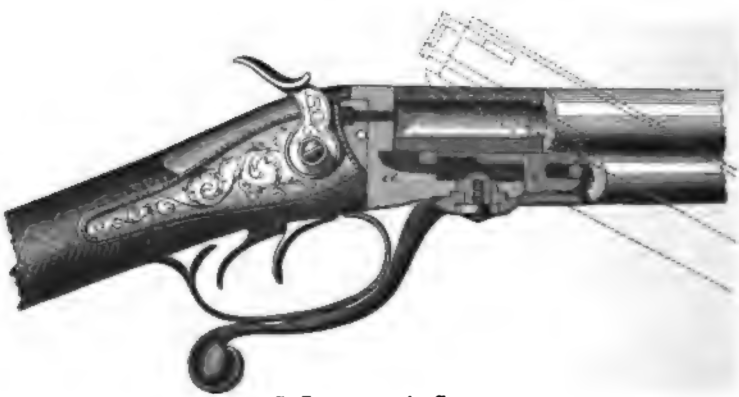
Fig. 2.



C. Lancaster's Cartridge.

them, in spite of a special tool made for that purpose as above mentioned. To remedy this defect, Mr. C. Lancaster, of New Bond-street, devised in 1852 a cartridge case (Fig. 1), in which the fulminate was contained between the solid copper base and a perforated metal disk fixed inside it. See Fig. 2. The disk acted as an anvil, being firmly secured in its position, while the copper base not being perforated retained the gas, which had a tendency to escape by the side of the pin, and it was consequently superior in that respect. He also devised the extractor as now made, and by its aid all the difficulties connected with sticking cartridges were completely got over. The gun in which this cartridge was used is shown in the annexed engraving in its closed condition, the position when

open being marked by the dotted lines. Its peculiarities are as follows: First, the striker was driven forwards by the breast of the hammer in a horizontal direction, impinging on the base of the cartridge; secondly, as the lever was moved to release the barrels, they were driven forward on the action bolt, a slot being cut for that purpose as shown in the engraving. This released a projection from their under side as shown at *a*, which had previously kept them down with great power, but when open the action had a loose feel which many people thought to be a source of weakness, and this, combined with the high price which C. Lancaster



C. Lancaster's Gun.

charged (60 guineas), kept them out of the general market. One of these guns was tested at my trial of 1858, but not from the maker, and it is not therefore fair to discuss its performance. In addition to the prime cost of the gun, the Lancaster cases were also more expensive than those of the Lefaucheux pin gun.

## SECTION V.

### The Pottet Cartridge and Daw's Gun.

The final improvement in the cartridge case, which has stood with slight alterations to the present time, was effected

some eight or nine years afterwards by M. Pottet, who patented it in Paris and London. This plan, with a slight change effected by M. Schneider, was introduced into England soon afterwards by Mr. Daw, gunmaker, of Threadneedle-street, London, and shown by him at the Exhibition of 1861, with a modification of Lancaster's striker, driven forward not by the breast but by the head of the hammer, and obliquely downwards and forwards instead of in the direct axis of the barrel. In the Pottet cartridge, the principle now in general use for exploding the powder was adopted, but the patent depended on the shape of the anvil, and this was easily evaded, so that it speedily drove the pin cartridge case out of the market, as the Lancaster extractor was also used. How this was done without C. Lancaster's consent, I do not know, but conclude there was some plan by which the latter's patent could be legally evaded.

## SECTION VI.

### Early Attempts at Improvements.

Such is a general history of the modern breechloader brought down to the introduction of the hammerless gun of the present day, but as a matter of detail sundry attempts were made to do away with asserted defects by various gunmakers. Thus, to avoid the hinge, Bastin devised a slide, in which the pin dropping into a hole drilled in the head of the hammer, the cases were drawn out as the barrels were driven forwards. The action, however, was heavy yet weak, and never came into general use. Mr. Needham, of London, and le Conte de Chateauvillier, in France, also tried to utilise the principle of the Prussian needle-gun invented in 1838, in which the base of the cartridge is perforated by a needle exploding the fulminate by friction instead of percussion, but neither of these

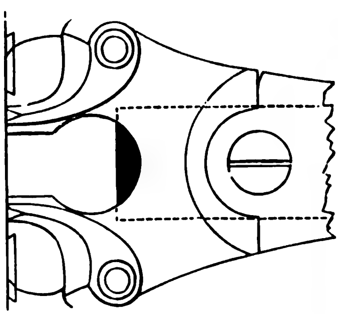
plans was favoured by the general approval of the public, though the former obtained considerable support. In his gun the side of the breech of each barrel was cut away to receive a breech bolt turning out on a hinge at its back, and in this bolt was contained the needle and lock. This necessitated an increase of length in the barrels to the extent of four inches, which was no doubt a considerable objection. The Chateauvillier gun had not this defect, but it was very complicated, and by no means approved of. Both these guns were without outside hammers, and may be regarded as the first of the series of hammerless guns which has now extended to a very long list.

## SECTION VII.

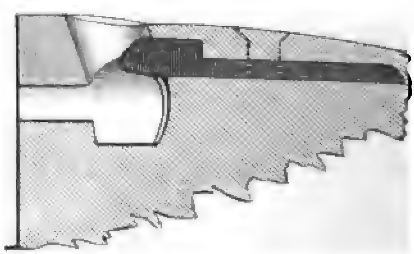
### First Important Improvements.

The first great improvement in the hinged or Lefaucheux action was made by Westley Richards in 1862, in which, instead of the grip which merely keeps *down* the barrels, an extension was made of the rib backwards, dropping into a slot cut in the break-off, and secured there from rising *up* by a hook working horizontally in a notch cut in it by means of a top lever. When thus kept down, the barrels and break-off are held together by the shape of the extension which, having a bulbous enlargement, is called the "doll's head," and is fitted into a corresponding socket. As first constructed this hook and its bearing were made too small, but, as I shall hereafter show, the plan, as now carried out, is strong enough to stand any test either of force or wear and tear. At first it was applied to the pin gun, but afterwards it was used with the central-fire cartridge, and still commands an extensive sale. As soon as the above improvement was effected I gave it my warmest approbation, and used it for some seasons without the slightest flaw, my gun

WESTLEY-RICHARDS GUN BUILT FOR THE AUTHOR IN 1868
(Two-thirds size).



PLAN OF BOLT IN WESTLEY-RICHARDS GUN, AND SOCKET FOR DOLL'S-HEAD (full size).



SECTION OF DOLL'S-HEAD AND BOLT IN WESTLEY-RICHARDS GUN (full size).

*Face page* 149.

made for me by the Birmingham firm proving to be the very best performer at the target I had ever tried. This gun was the first snap action brought out, and, as it thereby admitted of a slightly more rapid loading, it was highly approved of by many fashionable *battue* shooters, its success probably leading Mr. Purdey to devise his now well-known snap, which is really a stronger lump bolt than the double grip, though, like it, only keeping down the barrels, and not uniting them to the break-off—like the Westley Richards top connection. The next top connection was Mr. Greener's cross bolt, patented by him in 1862, which is even stronger than that of Mr. Westley Richards; but it cannot, by itself, be made to snap, and consequently he combines it with the Purdey bolt, with the aid of which the snap is effected, and the action is also strengthened.

## SECTION VIII.

### Arrangement in Three Leading Divisions.

I have thus briefly traced the history of the several plans by which the Lefaucheux action has been improved and brought to its present high form. They may be all included under three heads: First, The grip (single and double), by which the barrels are held down, requiring, however, the lever to be closed by the hand. Secondly, The various snap actions, in which the barrels are also held down, but in which they close of themselves by merely pressing down the breeches. Thirdly, The top connection, in which bolts or hooks are driven into an extension of the barrel, and keep them *down* as well as *to* the break-off. These include Mr. Westley Richards' hook, Mr. Greener's cross bolt, Mr. Tolley's cross bolt; a perpendicular bolt devised by myself, but not approved of by gunmakers on account of its cost; and an improvement on

the last-named invention by Messrs. Rigby and Bissell, which will be described in treating of the gun to which it is applied.

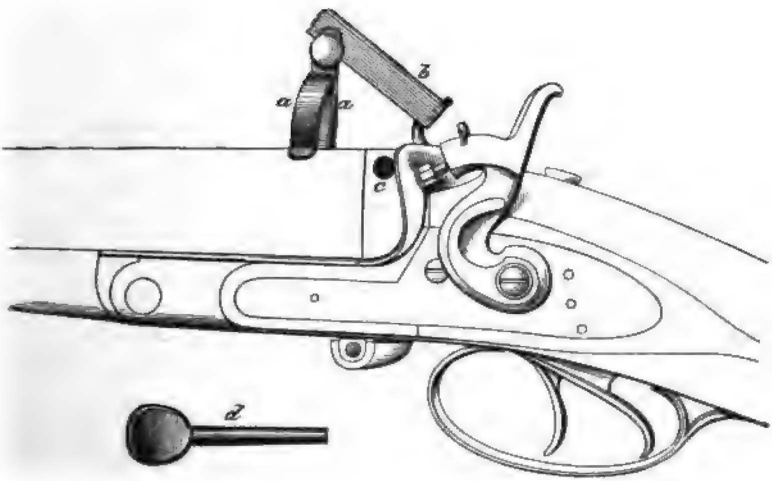
## SECTION IX.

### Bar-lock Action versus Back Actions.

All the above-mentioned actions may be made either with bar locks or back actions, and on this point a great deal depends in reference to their strength. With the latter the metal of the horizontal limb is not cut away to receive the lock, and the angle with the break-off is therefore very much stronger than in the case of the bar lock. For this reason, where there is no top connection, I prefer the back action, though, no doubt, in highly-priced guns, where the metal and the work are both good, the bar-lock action will stand against ordinary charges, that is to say, 3drs. or 3¼drs. of powder. The fact really is that, in this action, the angle gives way in the explosion, but returns to its original shape as soon as this is over, unless the charge is so great as to permanently change its shape or even to break it. In order to test this much-vexed question I procured a bar-lock action made by Mr. Greener in 1878, and fitted it with a little apparatus by which the opening at the top when it occurred could be proved in the following manner: His action, as is well known, combines the Purdey snap bolt with his own top cross bolt, the former being necessary in order to make the cross bolt snap, which it could not otherwise do. Instead of the ordinary cross bolt I substituted a removable one (see *d*), so that the gun could be fired either with the Purdey bolt alone or aided by the cross bolt. I then fixed a hook (*b*) to the top of the break-off and a screw-clip (*a a*) to the top of the barrels, so that a piece of silver paper could be stretched over the junction in such a way that, if this part opened, the paper would break. With this apparatus I proceeded in the

following manner, as subsequently reported in the columns of the *Field*, and to prevent the possibility of the breakage being caused by the mere jar of the explosion both barrels were in each experiment loaded equally, in which condition one was fired with the bolt in its place (*c*) and the other with the bolt removed.

Experimenting in this way, I found that in Mr. Greener's action no breakage occurred, either with the bolt in or out, using any charge of powder which the cartridge case could be




EXPERIMENTAL ACTION.

made to hold, until I charged it with sixty grains of the "Blisset" sample of Schultze powder, considerably compressed, a thin felt wad, and two ounces of shot, when the discharge of the first barrel (with the bolt in) produced no effect on the paper, but on removing the bolt the second discharge broke it up completely. Repeating this experiment, the same result again occurred, which I considered conclusive as to this powder. After this I confined my experiments to the Schultze of 1877-8, and that of 1878-9 used at the recent trial, together with Nos. 3 and 6 of Curtis and Harvey's black powder, as

follows—the shot in each case being 2oz. No. 6, introduced from the muzzle after charging the cartridge case with powder and an ordinary felt wad. In each case the bolt was in position with the firing of the first barrel, and was removed afterwards; but with the bolt in position the paper remained intact up to the last.

| | Powder. | Result. |
|---|---|---|
| 1. | 5 drachms Curtis and Harvey No. 6 ...... | No breakage. |
| 2. | „ „ No. 3 ...... | Ditto. |
| 3. | 55 grains Schultze 1877-8 ................. | Ditto. |
| 4. | „ „ 1878-9 ................. | Ditto. |
| 5. | 6 drachms Curtis and Harvey No. 3 ...... | Ditto. |
| 7. | 65 grains Schultze 1877-8..................... | Ditto. |
| 8. | „ „ 1878-9..................... | Slight breakage. |
| 9. | 7 drachms Curtis and Harvey No. 3 ...... | Ditto. |
| 10. | 75 grains Schultze 1877-8 ................. | Complete breakage. |
| 11. | „ „ 1878-9 ................. | Ditto. |

In the last case there was not only complete breakage of paper, but such a permanent opening of the breech of the gun as to stop the trial.

This experiment proves conclusively that with heavy charges (8, 9, and 10) the angle of the break-off will give way and yet return to its original shape, if there is no top connection, while with the bolt in its place, through the top connection, no such giving way occurs. Now we know by experience that a piece of iron may be bent backwards and forwards several times without breaking, but on continuing this bending for a considerable number of times a breakage shows itself by degrees. It follows, therefore, that a gun may be used for a time having this weak point in its action without accident, and yet may give way at last though the charge has not been increased. Now I hold that it is unpardonable to use an unsafe gun, however small may be the risk, if a safe one will answer equally well; and I therefore should advise all sportsmen either to insist on a top connection if a bar lock is a *sine quâ non*, or if they dispense with the top connection to use a back-

actioned lock. It is quite true that the latter compels the adoption of a larger hand, but anything is better than running a needless risk. At all events there is a choice left which can be seized, viz., the combination of the bar-lock and the top connection.

## SECTION X.

### Gradual Reduction of Cost.

When the Lefaucheux pin-fire gun was first introduced into England by Mr. Lang his price was 45 guineas, and Mr. Needham, as far as I remember, charged the same for his invention, Mr. C. Lancaster charging from 50 guineas to 60 guineas for his central fire, described at page 146. In 1861 Mr. Daw brought out his new gun (also a central fire) at the same price as Mr. Lang's, and for some years no breechloader was sold in London under that sum. About 1865 Mr. Lang produced a second quality plain gun, of course made at Birmingham, at 20*l.*, and this reduction was soon followed by Mr. Crane, of the Royal Exchange, and Messrs. Holland, of Bond-street, who advertised a plain central-fire, Birmingham-made, breech loader, at 15 guineas, which we were induced to report on favourably after trial, for the benefit of those who could not afford an expensive article. These prices continued for another ten years, when in 1874, Messrs Bland and Sons, of the Strand, advertised what is termed a Keeper's gun at 6 guineas, or if choked 7 guineas. This is a thoroughly sound and trustworthy weapon, capable, as was proved at the *Field* trial of 1879, of giving a good average pattern and penetration, though naturally not equal to the expensively finished articles which are at the head of the list. The gun, though quite plain, is wonderfully well made considering the price, and its use has been extended in many cases to masters as well as men. It is a back-action double grip, with rebounding locks

and hammers out of line of sight—patent fore-end fastener, and barrels now of English Damascus, though originally Belgian as tested in 1879.

Since that time several gunmakers have advertised a similar article, but the above firm may claim to have been the first to advertise a reliable gun at 6 guineas.


BLAND'S ORIGINAL KEEPER'S GUN.

A superior kind of cheap gun has also been produced by this firm, called their second-class "new model" Keeper's gun, at 10 guineas. The action is top lever, with Purdey's bolt and extension rib, but no cross bolt in it, being merely a plain doll's head. There are rebounding locks, having hammers out of line of sight, patent fore-end fastener, English Damascus barrels, either choked or cylinder. This gun is intended for sportsmen who cannot afford a long price rather than for keepers, and it certainly is a great boon also to the tyro, who is frequently not overburdened with cash. I there-

fore append an engraving, from which my readers may to a certain extent judge for themselves.


BLAND'S IMPROVED KEEPER'S GUN.

In the year 1875 the committee of the *Field* gun trial reported on the guns exhibited there, mentioning the prices at which they were sold. Of these only one was as low as 15 guineas, viz., that made by Mr. Tisdall, of Birmingham. Mr. Tolley's price was 25*l.*; Mr. Lincoln Jeffries charged 30*l.*; Mr. Crane, 37*l.*; Mr. W. Jones, 19*l.*; Mr Gates (Derby), 35*l.*; Mr. Green (Cheltenham), 25*l.*; and Mr. Adams, 18*l.* From these prices it will be seen that the reduction to 6*l.* in the year 1874 by Messrs. Bland and Sons, as above mentioned, was an enormous one, being 150 per cent. on the lowest figure, viz., that of Mr. Tisdall.

## SECTION XI.

### MACHINE-MADE GUNS.

In America machine-made guns have been constructed in large numbers, competing in price with the Birmingham trade, but I have never seen one which in my opinion would

bear comparison with those made in England by hand. In the stocking by machinery there is the great disadvantage that all must have the same bend and cast-off, whereas in hand-made guns made in large numbers variations in every respect are easy enough, and a customer going into a shop where a large stock is kept can readily suit himself, with the aid of the vendor, who directs him to put the gun up quickly to his shoulder and aim at the right eye of the vendor, who can readily see whether or no the aim is a good one. If he finds the aim good he is satisfied with the selection, if not he changes it for another which he thinks more likely to suit. Supposing the aim is below the eye, then a straighter stock is selected, or if too high a more bent one. If the aim is to the right or left, more or less "cast-off" must be adopted, which a skilled assistant readily detects. In this way a young hand is fitted with more certainty than in any other; and even in taking orders for an expensive gun the maker should not rest contented till he has temporarily fitted his customer with some gun selected from stock, even if it is not otherwise suited to him. No doubt a gunmaker of experience can generally build a gun to suit his customer by taking measure of his height, length of neck, and breadth of chest, but there is no test, in my opinion, equal to the above.

Having thus traced the alterations of price as far as hammered guns are concerned, I shall leave the consideration of hammerless guns in this respect till I come to describe that variety, and proceed to allude to other matters connected with the comparatively old-fashioned gun, in common with its more modern rival; and first as to the value of

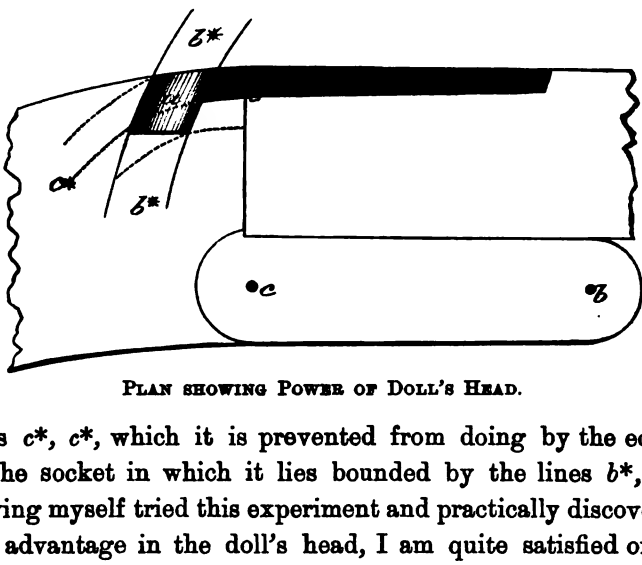
## SECTION XII.

### THE DOLL'S HEAD.

When Mr. Westley Richards brought out his new action about twenty years ago, I had fully satisfied myself that in

the Lefaucheux breechloader then in possession of the English market there was a constantly recurring opening between the breech and the break-off at each discharge. It was therefore with great satisfaction that I hailed his invention as a great improvement, and time has only strengthened the good impression that it made on me. "But," said his detractors, "look at the insignificant and weak tooth upon which all depends." On the contrary I replied, "The tooth has only to resist the tendency of the breech to rise, which is an indirect one; the real strain is that tendency to separate it at the top from the break-off, which is resisted by the extension provided with a bulb at the end, dropping into a corresponding cavity in the break-off." Mr. Westley Richards himself was accustomed to demonstrate the slight strain put on the tooth by removing it, and substituting for it a few turns of pack thread, which were quite sufficient to keep the barrels *down* during a discharge, the *separation* being still prevented by the doll's head. This experiment was, of course, sufficient to convince the customers of the firm, and the action has continued to the present day to receive the support of the public in large numbers, though strongly opposed by "the trade" in general. They even declined to adopt it in its entirety when the patent expired, though in many cases gunmakers do not scruple to accept the doll's head as an addition either to some snap bolt of their own or to the Purdey bolt, which is now also open to the public. Now the doll's head is completely a part of the Westley Richards patent, and no good end is obtained by discarding the original top lever catch, which is the simplest form in which it can be kept down. To show the power of the doll's head in keeping the breech to the break-off, it is only necessary to supplement the above-mentioned pack-thread experiment by a model arranged in the following way: Take an action provided with a doll's head, or an imitation made of thick tin will suffice for the purpose; but

to make it perfect the projection *a* must be swelled out on each side in a segmental form. Now, supposing the barrels, or the part representing them in tin, to be jointed to the action at *b*, then the doll's head will describe a circle bounded by the solid lines *b**, *b**, and will readily rise from its seat. But we will now suppose the barrels when closed to be fixed to the horizontal limb of the action between *c* and *d*, and that the action is jointed at *c*, which is the part where it gives way when tried as in the experiment described at page 151. Then the joint *c* will be firmly set, because the doll's head must describe a circle round it between the dotted




PLAN SHOWING POWER OF DOLL'S HEAD.

lines *c**, *c**, which it is prevented from doing by the edges of the socket in which it lies bounded by the lines *b**, *b**. Having myself tried this experiment and practically discovered this advantage in the doll's head, I am quite satisfied of its efficacy, and can strongly recommend it as answering its purpose with the Purdey or any other bolt which will keep the barrels *down*, just as well as with Mr. Westley Richards' original bolt, and with a slight advantage in many cases in point of bearing surface. With these two experiments to prove its efficiency it is idle to assert, as many do, that the doll's head is useless without the Westley Richards catch,

because when the catch is removed it readily leaves its bed. The question really is, what is its power and effect when the catch or snap has not been removed, which I have endeavoured to answer in the above explanation. But it has still another advantage over its rivals, consisting in the absence of all friction when the gun is opened and closed. In the various grips, snaps, and cross bolts, this is an important element, for they all have to submit to a considerable amount of it, whereas the doll's head barely touches its bed until it finally rests there. No "draw" is wanted, and in fact could hardly be obtained, so that no friction accrues. The only force applied to the doll's head is through the blow caused by the explosion, which is distributed over its anterior surface, and can be readily resisted if the fit is a good one, because there is no room for the metal to expand into. Lastly, the Westley Richards action is opened by a top lever, which is so convenient that by public accord it has been adopted by most of the fashionable gunmakers of the day; that is to say, whereever it was possible to do so. Even the Purdey snap bolt, which is now in almost universal use, was first brought out with a lever under the guard; and, indeed, so was Mr. Greener's cross bolt, which, instead, as is now done, of being combined with the Purdey top lever snap, was used with the double grip and lever below the guard. To Mr. Westley Richards, therefore, we owe the invention, first, of the top connection, known as his in its entirety; secondly, of the top lever; and thirdly, of the doll's head as used in combination with other bolts, and all these so early as 1862.

There is, however, one serious objection to the doll's head in common with all other top connections, viz., that its existence greatly interferes with the repairs rendered necessary when the hinge becomes loose, or the face of the breech end of the barrels is worn away by the carelessness of keepers or of sportsmen themselves. Where there is no projection the

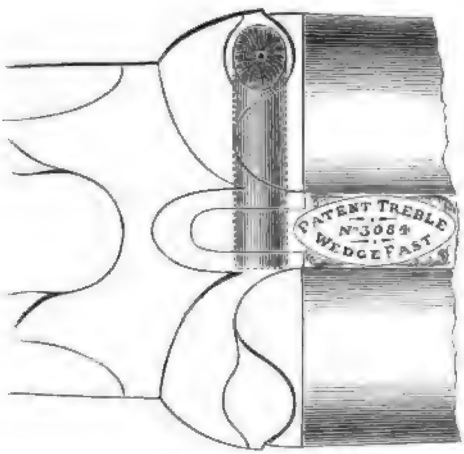
plan is to cramp the barrels to the break-off, and then taking out the hinge bolt, grind a somewhat larger hole, into which a new bolt is fitted, when the action is, on a cursory view, restored to its original close fit, the process being technically called "facing up." This improvement is, however, more apparent than real, for though the two faces come together as when new, the front of the wedge cut in the lump (see page 96) no longer takes a bearing, and the force of the explosion is borne solely by the bolt. This is no doubt one of the reasons for the opposition offered by many gunmakers to the doll's head in common with all top connections, which would otherwise be unintelligible. "I warrant my gun," say they, "to keep its joints for years, or, if it does open, to put all right for nothing;" or, perhaps, "for a few shillings." I confess that I prefer a gun which will keep tight without repair if properly used, for it is the master's own fault if, either from his own carelessness or that of his servants, the breech ends are worn away.

## SECTION XIII.

### Cross Bolts.

In 1865 Mr. Greener, probably seeing the advantage of the Westley Richards action, introduced his cross bolt, having previously tried without success a bolt driven from the top of the break-off into the rib of the barrels. At first, as I have remarked above, this cross bolt was moved laterally by the lever of a double grip, and even then it was necessary to avoid its entering the other side of the slot in the break-off, which of course greatly diminished its strength as compared with its present form, which is represented in the annexed cut. This shows the top projection completely perforated by the cross bolt, all being of full size—and will satisfy any mechanical mind of the strength of this action. As now

used, a Purdey bolt is applied in the ordinary way, which, as we shall presently see, keeps down the barrels as strongly as the double grip, and, being a snap-bolt, the gun is readily closed as far as it is concerned. At the same time a top lever is added which works both bolts, and is in turn acted on by both, so that as the Purdey snap is pushed back it takes the lever with it, and this again draws the cross bolt from its bearings, admitting the top extension to its proper slot. The pressure on the snap being then removed, its spring acts on




MR. GREENER'S CROSS BOLT (full size).

it, and carries it home, taking the lever with it, and this again driving the cross bolt home.

An examination of the engraving on the next page will show the several bearings of Mr. Greener's "treble wedge-fast" gun, namely, first, the hole in the top extension; and secondly, the two notches in the lump into which the Purdey snap plays. Probably this is as strong an action as can be devised, perhaps more so than that of Mr. Westley Richards, because the bearing surfaces are larger; but, unlike his, all the parts are liable to wear by friction. Still, from

my own experiments and that of the celebrated Dr. Carver, who used one for many thousand times without sign of wear, I am satisfied that it will stand an immense deal of work, while its neat appearance is entirely in its favour. This combination

MR. GREENER'S TREBLE WEDGE FAST GUN (half size).

was patented by Mr. W. W. Greener in 1873. It will be seen that the hammers are well out of the line of sight, and that the strikers are nearly in a line with the axis of the barrel.

For some years the members of the gun trade, with the exception of Mr. Westley Richards and Mr. Greener, made no endeavour to strengthen their actions by connecting in any way the top of the barrels and the break off. But as time told its tale by showing how soon the action wears without some such means of strengthening it, their eyes were opened, and two of the leading Birmingham firms, Messrs. Powell & Son and Messrs. Tolley each made the attempt. Of these Messrs. Powell and Son's is only a strong keeping *down* bolt with the addition of a doll's head, but Messrs. Tolley's is really something more, the cross-bolt entering a dovetailed notch in the extension rib and holding the barrels *to* the break-off with a considerable degree of strength. This will be evident if they are compared as described in the following pages.

## Messrs. Powell and Son's Cross Bolt Action.

In the year 1878 an action, patented in 1876 by the above Birmingham firm, was submitted to me for report, under the name of their "treble lock-fast action."

Fig. 1.—Powell's Treble Lock-Fast Snap Action Breechloader (one-third size).

It consists, as is clearly shown in the annexed engraving, of a strong squared cross bolt *b*, which, however, only keeps the barrels down, as in the Westley-Richards action, and does not hold them together like the Greener cross bolt. This latter task is, as in the Westley-Richards, performed by a doll's head *e*, which, like the similar projection in that gun, keeps the two together as long as the barrels are kept down, but this office is certainly very well performed by the cross bolt, Fig. 2, fitted carefully into a slot cut in the break-off *c*, and moved sideways so as to project to the left by the top lever. This cross bolt is made to bear with a considerable "draw" or "grip" on a continuation of the lump projecting backwards (see Fig. 1). The action is certainly a very strong one, as long as the break-off keeps sound; but this part requires to be made of extremely good metal, as

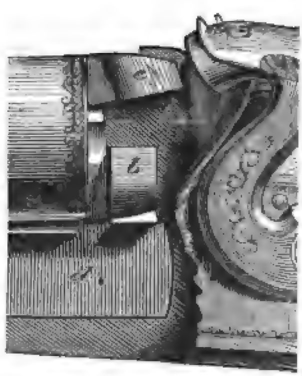


Fig. 2.—Powell's Cross Bolt, with Break-off cut away to it and Doll's Head (full size).

a great part of its angle is cut away to receive the cross bolt and the prolongation of the lump, while the use of a bar lock still further removes the metal. Indeed, if it were not for the doll's head I do not believe it would stand the strain of a heavy charge.

### Messrs. Tolley's Giant Grip Cross Bolt.

About the same time Messrs. J. and W. Tolley, of Birmingham, patented another form of cross bolt, which has the

Messrs. Tolley's "Giant Grip" Action opened for Loading (full size).

merit of keeping the barrels and break-off together, as well as the barrels down. In this plan there is a top extension without a doll's head, and when in its place a dovetailed semicircular groove is cut in it and in the top of the break-off, allowing a hook of a corresponding shape to work horizontally

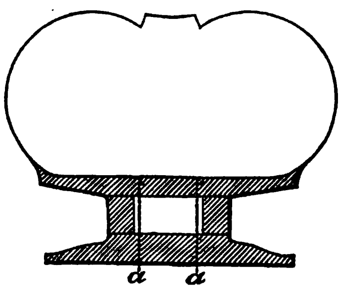
in it, moved by a top lever. A Purdey bolt is added, without which the hook would possibly be too weak to keep down the barrels, but as long as this hook is entire the action is strong enough to bear any strain whatever. The gun is very neat, with hammers sunk beneath the line of sight, and bar locks, the use of which are justified by the strength of the top connection.

The above include, as far I know, all the forms of cross bolt which have been submitted to the public.

## SECTION XIV.

### THE PURDEY SNAP-BOLT ACTION.

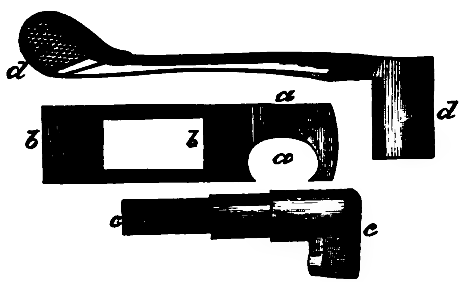
In the year 1867 Mr. Purdey patented his now celebrated bolt, for which he has never yet obtained the credit which he deserves in any published description of the gun with which I am acquainted. At page 96 I have described the lump as projecting downwards into the action in two divisions, occupying the space between the lines (*a a*) shown in the annexed section. Each of these divisions has a notch cut in its posterior




SECTION OF THE BODY OF PURDEY BOLT ACTION (reduced in size).

surface to receive the corresponding parts of the bolt. We must next examine the cross section of this action as designed for a bar-lock and shown above. The blank space is occupied by the bolt, which slides backwards and forwards in it. The

middle of this bolt is cut away exactly to the width of the posterior division of the lump (page 96), so that when the bolt is in its place the lump can descend into the action through the hole in the bolt. When this is done the bolt is pressed forward by its spring, its front edge entering the anterior notch in the lump and the corresponding edge of the hole occupying the other. Both of these edges are bevelled off above, so that the lump as it descends snaps the bolt back till it clears the notches when it enters them, and the action is closed. At the same time the whole length of the bolt has a bearing of about one-sixteenth of an inch within the action, as will be seen in the section at page 165. All this metal being cut away, and also that necessary for the introduction of the bar-lock, there is




PURDEY BOLT AND LEVER (slightly reduced in size).

great weakness in the angle of the action, which, in my opinion, necessitates the top connection. As before remarked, when first brought out this bolt was opened and closed by a lever let into the trigger-guard; but it is now acted on by a top lever resembling that of Mr. Westley Richards, and passing obliquely downwards to a point a little out of the centre of the bolt, so as to move it about one-eighth of an inch backwards and forwards as the lever is turned outwards, when it is brought back again by its spring. Of course the lever is applied to this descending part by squaring it on in the usual way. The engraving shows the shape of the cam *c*

working in *a a*; *b b* its two teeth or bearing surfaces, *c c* the upright portion of the lever, and *d d* the horizontal limb, or that which is apparent to the eye in the finished gun.

But though this bolt is an excellent one for the same purpose as the double grip—that is to say, for keeping the barrels *down*—it has no other effect, and by itself it is only to be fully relied on in a back-actioned gun, where no metal is cut away. Messrs. Purdey and Sons nevertheless continue to use it alone for their best guns, adopting the back-actioned lock for those of second quality. This is certainly a step in the right direction; because it requires the very best workmanship and material to bear the strain on the break-off when there is no top connection in bar-lock actions. Mr. Grant, of St. James-street, on the other hand, is content with the back-actioned lock, and for this I certainly give him great credit.

## SECTION XV.

### Single Snap Bolts.

Until the patent protecting the Purdey bolt expired about two years ago numberless single snap bolts were in vogue;

Messrs. Powell's Single Snap Action (one-third size).

but since that time, by general consent, the former has been adopted by nearly every gunmaker in Great Britain, and no doubt, as I have before remarked, it deserves its high position.

Among the latter Messrs. Powell and Son, of Birmingham, may be noticed as having patented a single snap bearing on the lump, generally approved of by their customers. This snap is moved by a top lever, which is lifted instead of being turned sideways, but, as the lifting has a tendency to prevent the fall of the stock in opening the gun, the plan is objectionable on that score. Nevertheless, in the Midland Counties, to which Messrs. Powell's connection is chiefly confined, their action has been adopted to a very considerable extent.

## SECTION XVI.

### Miscellaneous Actions.

Among the breechloading actions which are not to be classed as improvements on the Lefaucheux, I may mention that of Mr. Bacon, to which there is the same objection as to Needham's needle-gun, namely, that four inches of the barrels are sacrificed in order to get the lock in behind the breech. In his action there is no hinge, and the locks each lie in the posterior portion of the corresponding barrel, and are turned out to admit the cases. These are driven back into the jaws of a spring extractor which lays hold of them and draws them back; but, though the gun is no doubt a strong one, it has not taken hold of sportsmen, and is now I believe out of the market. I may also mention Mr. Jeffries' side action, in which the barrels, instead of turning down, turn sideways on a centre placed in front of the breech; but this plan is also abandoned. Mr. Dougall's lockfast action was for some years supposed to be a very strong one, combining the drop of the Lefaucheux with the sliding motion of the Bastin breechloader, described at page 147, by means of an eccentric action bolt. Two projecting discs are also left on the face of the break-off,

upon which the open breeches are brought back so as to keep them down when locked. But, as there is no difficulty in this keeping down either by means of the double grip or Purdey bolt, and as no top connection is afforded, the plan has not stood the test of practice, and is now very seldom adopted.

## SECTION XVII.

### Self-cocking Hammered Guns.

About the year 1860 several plans for cocking or half-cocking hammered guns (which then had almost exclusive possession of the market) were brought out by Greener, Pape, and others, but they were more or less unsightly, the cocking arrangement being external, and were not in general use. In 1866 I provisionally protected one in which for the first time a projection from the barrels on each side was made to impinge on the breasts of the hammers, and so raise them to full cock, as the barrels fell. Like those already mentioned, however, it was unsightly. I exhibited it at the 1866 gun trial, but did not think it worth pursuing, but it undoubtedly was the germ of the plan afterwards carried out in the hammerless gun by Anson and Deeley, Lang, Scott, and others. One of the earliest forms brought out was

### Harrison's Patent Self Half-cocking Action.

The annexed engraving shows this action open. As the lever B is depressed, it releases the hook from the notch G in the lump beneath the barrel D, and at the same time drives the hammer C up to half-cock by pushing up the bolts H by a very simple arrangement. The committee at the 1875 gun trial gave their opinion in favour of this action, which was

patented by the firm of Cogswell and Harrison, Strand, near Temple Bar.


HARRISON'S PATENT SELF HALF-COCKING ACTION.

## MESSRS. LANG'S SELF-COCKING GUN.

In 1875 Messrs. Lang, of Cockspur-street, London, brought to my notice a plan in which the cocking of a hammered gun is effected by means of an underguard lever bearing internally on the tumblers, which I then described in the *Field* as follows :

Several self-cocking guns have been before the shooting public lately, of varying degrees of merit—all having, it is true, some advantages over the ordinary breechloader in point of rapidity, but, as their warmest admirers will admit, all possessing one or two grave defects.

The chief among the objections to them is probably the great exertion required to full-cock both locks and open the gun, which entails some hard work upon a man of average strength of wrist in the course of a long day's shooting, and interferes with his aim.

Another serious defect in most of the guns we have hitherto seen is their liability to missfire, consequent upon the use of the tumblers themselves as strikers, and thus producing a short and cramped blow, resembling that of the Martini-Henry rifle.

After a careful examination of Messrs. Lang and Son's new gun, we think they have succeeded in removing these defects, and there seems no reason why the use of the self-cocking sporting gun should not now become as general as that of the self-cocking military

Messrs. Lang's Self-cocking Hammered Gun.

weapon, especially for the purposes of the battue. At all events, the new gun is in advance of anything of its kind we have yet seen.

It is to all outward appearances the common central-fire gun, with the lever under the trigger guard; but upon pressing the lever forward the gun is opened and full-cocked in one motion, with very little greater exertion than is used to open an ordinary snap gun, the pressure being only about 8lb. or 9lb.

The ease with which this is accomplished is a remarkable feature of the gun, and is the result of a thoroughly mechanical adjustment of the lever and reduction of all friction to a minimum. The hammers and strikers of the new gun working exactly as in an ordinary central-fire gun, the chances of missfires are no greater in the former than in the latter, while the gun may be half-cocked or full-cocked by the thumb at pleasure. It seems that there are other advantages in having the strikers outside the lock; for instance, no escaping gas can get into the lock through the striker hole; while a broken striker is less probable, and, if it happens, more easily replaced.

## Messrs. Woodward's Self-cocking Automaton Hammered Gun.

In the following year an action closely resembling externally that of Messrs. Lang, was also described by me in the *Field*, and also differing very little in its internal arrange-

Section of Woodward's Automaton Gun, Open and Cocked.

ments. I am not aware whether Messrs. Woodward, of St. James-street, or Messrs. Lang, have the prior claim to this invention, and can only leave this matter to be settled among themselves. The internal construction of Messrs. Woodward's gun is shown in the annexed woodcut, its exterior being almost identical with that given at page 171.

MESSRS. HOLLAND'S CLIMAX SELF-COCKING GUN.

Another self-cocker is that called by Messrs. Holland, of New Bond-street, their Climax, though that name has since been used for a hammerless gun. It was described by me in the *Field* of Oct. 25, 1879, as follows:

In this self-cocking gun the object aimed at is attained by means of a segmental lifter jointed to the front of the lever A, and working in a slot cut in the break-off, with a spread


MESSRS. HOLLAND'S CLIMAX HAMMERED GUN OPENED AT HALF-COCK.

at the top (B), where it lies under the heads of the hammers, and is sunk out of sight when the gun is closed. It may be used so as only to half-cock the gun, or to full-cock it at pleasure, depending on the extent to which the lever is depressed. It is a very neat piece of work, the only objection patent to us being the situation of the lifter, which of course cannot be kept dry in wet weather; but, being very free, it would not, we think, be impeded by rust, and, as the slot is not open to the locks or action, no real

harm can accrue. It has the great advantage of opening with a pull on the lever not exceeding that of an ordinary hammer, viz. 13lb. or 14lb. Messrs. Holland's claim is that the action possesses the following merits, to which it appears to us, in the main, they are entitled:

"This gun is opened, and the locks placed to half-cock or full-cock at pleasure, with the minimum of force applied to the lever, which can be placed either under the guard, or between the hammers as a top lever. The great object obtained in this principle of action in its simplicity, and the ease with which the bolts of grip are opened, and locks placed at full or half cock. The first is obtained by applying the lifting arm to the extreme end of the hammers. In all other self-cocking actions as applied to double-barrelled guns, the lifter is nearer the axle, consequently less leverage is obtained, and more force is requisite to raise the hammers. Ordinary gun locks are used.

I do not remember any other varieties of the self-cocking hammered gun, which no doubt led to the introduction of the hammerless one in its present form.

## SECTION XVIII.

### General Remarks.

In the preceding remarks I have carefully avoided giving any opinion on the workmanship of the several guns alluded to except in relation to price; nor have I attempted to compare guns actually made in London (except as to their barrels, which are all either from Birmingham, Belgium, or France) with those altogether turned out at Birmingham. Those sportsmen who are regardless of price do not mind paying for extra style, and this is altogether a matter of taste; so that it would be scarcely fair to pass any opinion on it. Thousands of guns sold in London are altogether finished at Birmingham, while some are sent up "in the soft," and, after being stripped, and having attention paid to their locks, are sent back to be browned and case-hardened, which processes are carried out at

Birmingham as well as or better than anywhere else. All that I have attempted has been to describe the principle of the various actions now in the market, without reference to workmanship, and also to trace the steps taken in the decline of prices from forty or fifty guineas down to six guineas, for below that sum I have seen no gun sold which could, in my opinion, be relied on for safety and efficiency. Of course the six-guinea gun will not bear comparison with those sold at fifty guineas by the fashionable London makers, but still they are well fitted for men who must cut their coats according to their cloth.

# CHAPTER VII.

## THE HAMMERLESS BREECHLOADER.

### SECTION I.

#### History of the Invention.

About twenty-five years ago, Mr. Needham, a London gunmaker, brought out a hammerless gun, which was the first used in this country, and for some time the only one. Founded on the principle of the German needle-gun, it was, however, a great improvement on it, and was highly approved of by many good sportsmen, including the Earl of Craven of that date, who adhered to its use for several successive seasons. It had, however, the disadvantage that the base of its cartridge case was left behind to be pushed before the next charge, the result being a great reduction in force and variation in pattern; so that on this account it never attained a very considerable sale. Moreover, it required an extra length of barrels to the extent of four inches, in order to lodge its locks, which were turned out sideways for the insertion of the cartridge, lying in the barrel itself when the gun was loaded. It is interesting, however, as the germ of the now fashionable weapon, but I do not consider that it deserved even the slight amount of patronage which it received.

To Mr. Daw, of Threadneedle-street, London, is due the credit, if credit there be, of devising the first gun without hammers, using his improvement on the Pottet cartridge with its detonating cap, instead of the friction cap used by Mr.

Needham. It was patented in 1862, but was a clumsy piece of mechanism, and never attained any degree of popularity.

MR. MURCOTT'S HAMMERLESS GUN.

The next step in this invention was taken by Mr. Murcott, of the Haymarket, who patented his plan in 1871, and sub-


MR. MURCOTT'S HAMMERLESS GUN.

mitted it to me for publication in July, 1872, when I described it in the following terms;

The advantages offered by this invention, according to the inventor, are a clear line of sight, great rapidity of action, perfect security, non-liability to accident, and extreme simplicity of construction. The first is attained by doing away with external useless hammers, giving an uninterrupted view of the whole field—a great advantage to the use of the second barrel. The second is accomplished by the lever which opens the barrels to receive the cartridge also cocking the gun at the same time, by one simple and easy movement. The third is insured by the bolt on the top, by which the gun is secured from all possibility of discharge; and the fact is indicated in gilt letters. The fourth is exhibited in the entire absence of external projections, which every sportsman has found to be a desideratum, since the catching of the hammers has been the cause of many fatal gun accidents in passing through a hedge; whilst the fifth is shown by a glance at its very simple mechanical principle. The old and well-tried gun lock is retained in its best and strongest form, to which the strikers are connected, so that they are withdrawn in opening the gun—thus dispensing with spiral springs, which are found to get frequently out of order.

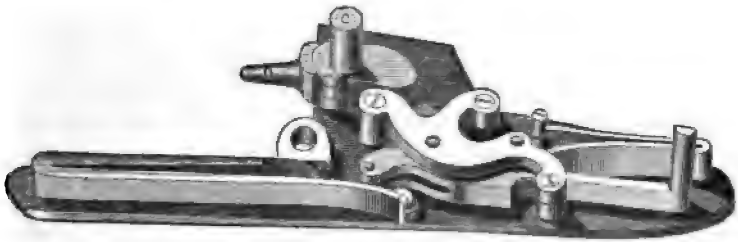
The strikers and all other working parts being effectually protected from wet, dirt, and grit, a fruitful source of missfire is entirely obviated. As there is nothing to impede the action of the mainspring, its full force is delivered direct upon the cartridge.

In our engraving the gun is opened, the lever A A A having withdrawn the retaining bolt B, and at the same time raised the tumbler arm C to full cock. The striker D is jointed to the tumbler arm C. The cartridge extractor E is driven home by the descent of the barrels in the usual manner.

To load the gun proceed as follows: Having removed the exploded cases and replaced them by loaded ones, then close the gun with a snap, which action is facilitated by the use of an additional top bolt, F, on the extractor face, thus gradually and smoothly closing the gun. This bolt F drops into the rib of the barrel when closed.

Here the interior of the lock is shown. As can be seen, it is of the ordinary construction, with the addition of C, the projecting arm of the tumbler, which is acted upon by the lever in opening the gun, and so raises it to full-cock. To this arm is attached, by

a hinge joint and pin, the striker D, which is consequently drawn back by the lever with the tumbler whenever the gun is opened; and it cannot be closed by any chance without the strikers being withdrawn from the action face.



LOCK OF MURCOTT'S HAMMERLESS GUN.

In the above description it will be observed that I was at that time satisfied with the safety bolt which only bolted the triggers. Subsequent experience in its use by various correspondents, however, convinced me that something more was needed, and that a safety bolt of a different construction was needed to prevent the going off of the scear from its bent, and also that it should be automatic, which views were at the time I brought them prominently forward strongly contested, but are now generally admitted to be correct. The Murcott gun is, however, now superseded, and I need not therefore further allude to it, except as being the first hammerless gun entitled to commendation.

## SECTION II.

### MODERN HAMMERLESS GUNS.

Early in 1874 Messrs. Gibbs and Pitt, of Bristol, submitted to me an improvement on Murcott's gun which I thus described in the *Field* of Jan. 17, 1874:—

### MESSRS. GIBBS AND PITT'S HAMMERLESS GUN.

The object of this invention is to render the gun self-cocking by the action of the grip or snap lever, so that when the grip lever is

opened, or the snap lever depressed to open the barrels, the hammers are lifted to full-cock. This is accomplished in the gun by the introduction of a loose rod or connecting piece *c* passing through the back of the action, and in the snap by jointing a piece to the back of the bolt which holds down the barrels; and in each gun the part holding down the barrels in the firing position is made the medium or agent for cocking the gun. When the gun is thrown back, or the snap lever closed by throwing up the barrels, the cocking bolt is withdrawn, so as not to interfere with the fall of the hammers.


MESSRS. GIBBS AND PITT'S ORIGINAL ACTION AND LOCK.

By this patent the ordinary locks are superseded by locks of a new form and simple construction, contained within the case *d*, whereby the hammers *a* are placed lower and in a better position for delivering their blow on the strikers; and the great importance of this improvement is evident from the many different plans resorted to in the guns now in use for getting the strikers and hammers into a good and efficient position.

Levers *b* are placed outside, as shown in the drawing, by the use of which the gun can be placed at half-cock when necessary, or

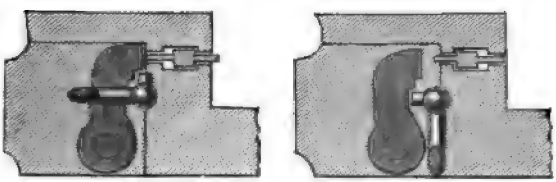
with which the locks can be worked in the usual way; and these levers also serve as indicators: but if a gun is required without any outside projections they may be entirely dispensed with. If the gun is required to be used without its self-cocking action, it may be done by the removal of the cocking pieces described above; but in that case a safety bolt must be introduced.

The patent is applicable to double and single guns and pistols, and the advantages to be obtained from its use are, increased rapidity in loading and firing, which in battue shooting and driving are most important; likewise greater facility in aiming, by the absence of any hammers projecting above the barrels. With the double grip it is also specially applicable to rifles.

This gun has subsequently been altered in various ways, among others by the addition of a safety bolt, which, however, had at first the disadvantage of allowing the striker to explode the cap, when let down from "safety" to firing.

To prevent any accusation of misrepresentation, I append this bolt as described and illustrated by Mr. Gibbs himself in his catalogue recently published (Figs. 1 and 2), as follows:—

FIG. 1. FIG. 2.



MESSRS. GIBBS AND PITT'S SAFETY BOLT.

The bolt used in the first year with my guns was a rod passing through the top of the tumblers, and by pressing down a lever outside the lock plate they were drawn backwards free of the triggers, where they remained until the bolt was placed back to its original position. An improvement on this plan was found necessary, as when one barrel had been fired it was necessary to open the gun before both locks could be again bolted, and another form was then designed which is called the barrier bolt, this has been in use up to this time and answers admirably. Pressing down this bolt by the small lever outside the lock plate a barrier is placed in front ot the striker, as shown in Fig. 2, and it is impossible the gun can be fired by any means until it has been unbolted by turning the lever upwards, which removes this barrier.

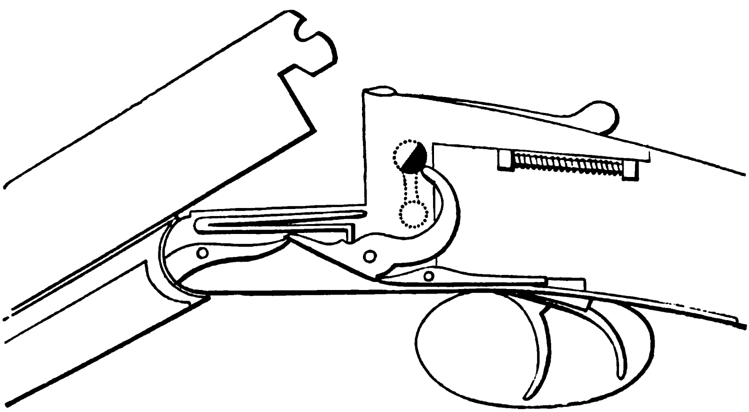
In this amended form a notch is cut in the breast of the tumbler, preventing it from being let down if the trigger has been pulled upon it, which frees the bolt from that risk, but it demands an additional trigger bolt. I regret to observe that Mr. Gibbs is still opposed to automatic bolting, and considers an optional bolt quite sufficient.

The principle of this invention resides in the cocking by means of an extension from the grip lever or Purdey bolt, as the case may be, which is made to raise the tumblers by thrusting back on a projection from their insides a horizontal limb as shown at *c*, page 180. The Purdey bolt is now generally adopted for this purpose, and it is only necessary to prolong it about half an inch in a forked form to make it effect the cocking. It will be seen by reference to the engraving at page 180 that Mr. Gibbs's first gun had a projecting trigger plate, somewhat interfering with the fore-finger in pulling the trigger; but in his present model this is done away with, and the lock is modified considerably, to the great improvement of the appearance of the gun. It is still back-actioned, resembling in other respects that drawn at page 231, so that no top connection is necessary, according to my ideas on that subject. He continues to use the under guard lever, and this is, I think, better for the purpose than the top lever adopted in another pattern now much in vogue, which I shall describe in due course. Mr. Gibbs's own pattern I consider an excellent one in all respects but the safety bolt. Until indeed very recently, however, the gun has not had an efficient safety bolt, but with the addition of one on the plan either of Messrs. Scott, Mr. Silver, or Messrs. Jones and Penn, hereafter described, the gun is made perfectly safe in that respect. For a fuller description by woodcut, &c. of the recent improvements in this action and of its combination with the various safety bolts, I must refer my readers to Section IV. of this chapter, treating of safety bolts generally.

The first hammerless gun in which the tumbler was cocked by the fall of the hammers was invented and patented in 1875 by Messrs. Anson and Deeley, both of whom were at that time engaged by the firm of Westley-Richards and Co.

### The Westley-Richards Gun with Anson and Deeley's Lock.

As originally produced before the public in 1876 and described in the *Field* of July 15 in that year, it was constructed according to the following diagram.

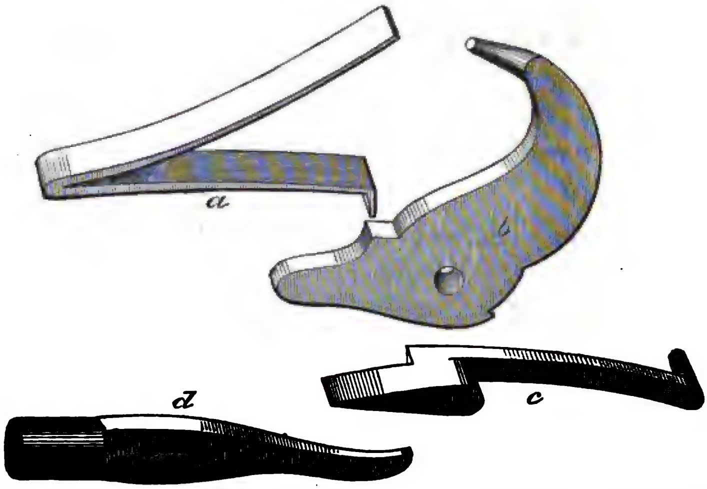


The Westley-Richards Gun with Anson and Deeley's Lock Opened at "Safety."

In this action the cocking lever occupies the position in its body of the hinge bolt, and it is therefore necessary to cut the bolt out of the solid metal which is an expensive process in "actioning," and also prevents any future "facing up," because a new bolt cannot be fitted in as described at pages 159-60.

This is the only novelty in the *action*, the patent otherwise depending on the *lock* and *cocking lever* which have already

been described at page 126, but I append the limbs in order to make the matter clear.




LIMBS OF ANSON AND DEELEY LOCK (without scear spring and pins, full size).

It will be seen that the simple Westley-Richards top connection and bolt are used for the action, but that the lock is altogether different. In the first place, by fixing the centre of the tumbler opposite and below the face of the breech and constructing it of a segmental form, its point may be made to explode the cap without the intervention of a jointed striker, as in Murcott's gun; secondly, by continuing forwards a limb from the tumbler *b*, it is acted on by a lever *d* attached to the fore-end, which, by raising it, forces the tumbler to full-cock. In this way, as the barrels fall to expose their breech ends, the gun is full-cocked. The swivel and hook of the ordinary lock are dispensed with, and the whole of the lockwork except the scear is inclosed in two slots cut one on each side of the action from below, to be afterwards protected by a thin plate of iron. A safety bolt with a short lever lying outside the break-off was so constructed that, half being cut away, it arrested the striker

when in the position shown in the plan, Fig. 1, but would let it pass if moved to a half circle. It was, however, found in practice that this bolt, like that of Messrs. Gibbs and Pitt,

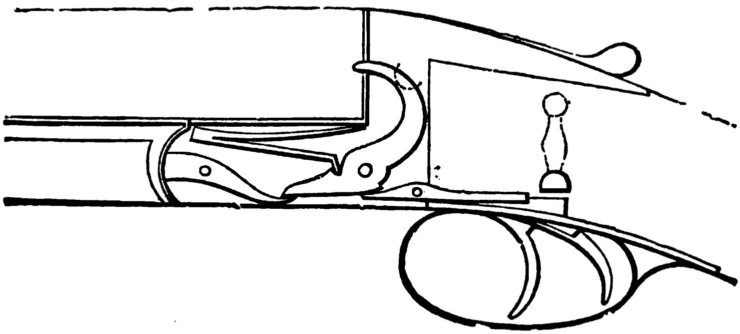
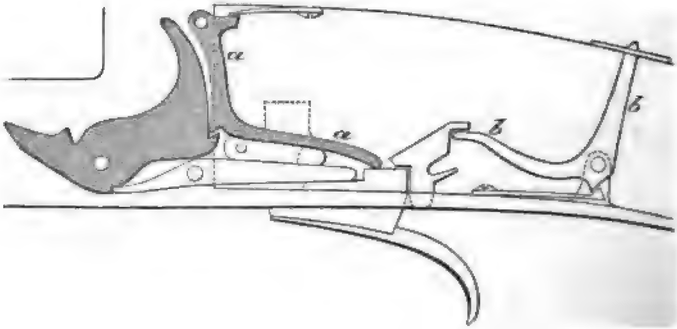


Fig. 2.—The Anson and Deeley Action Closed, with Trigger Bolt at "Firing."

allowed an explosion to take place when let down from "safety" to "firing," and it was at once decided to withdraw it and alter all the guns sent out with it, the trigger bolt, Fig. 2, being substituted for it. This gun at once attracted very general notice, but it was for a long time without what in my opinion was a satisfactory safety bolt, and notably without an automatic one. Even in 1878, when adopted by Mr. W. W. Greener and patronised by General Goodlake as "the gun of the future," the lock was still only safety-bolted as is described above.

Very recently, however (Sept. 1882), the Westley-Richards Company have brought to my notice an excellent safety bolt (on the principle of Scott's) applied to their lock. The automatic trigger bolt is exactly as they have used it for the last three years, but in addition is a limb, *a a* (see engraving), always ready to catch the tumbler striker (in which is forged a small lump for a bent), except when raised out of gear, as in Scott's "Safety," by the pull of the trigger. It is described by Mr. Deeley as follows: "The improvement is the application of

an additional or secondary scear to each tumbler. The nose of each scear engages in an extra bent formed at the back of the




ANSON AND DEELEY'S SAFETY BOLT (1882).

tumbler, and its tail is extended on to the trigger. The trigger acts upon the secondary scear before it moves the scear proper; but if the scear proper should get broken, the secondary scear performs its function, and, as it engages in an ordinary bent in the tumbler, the pull-off, if the secondary scear be used, is just the same as with the scear proper."

This is a very neat arrangement, and is an excellent addition to the ordinary Anson trigger bolt, *b b*. I am much pleased to be able to announce that the Westley-Richards Company are converted to my views as to the necessity of an automatic bolt on the tumbler as well as the trigger, and that henceforth they will recommend the use of both to their customers.

The following is Mr. Greener's first hammerless gun, in which he combined his treble wedge fast bolts described at page 161, with the Anson and Deeley lock and safety bolt, page 183. This gun was strongly recommended to the readers of *The Field* by General Goodlake, V.C. on the 14th January, 1878, as "the gun of the future," and his high authority as a game shot speedily brought it into such general

use that a host of rivals have since that time made their appearance. I extract the following sentences from his letter.

The absence of hammers makes the gun very convenient, especially for covert shooting. I have tested, as far as I possibly can, its durability in all weathers, and in heavy shooting. Added to which I cannot speak too highly of its simplicity, combined with safety and ease of manipulation. There is no half-cock, but in its place there is a safety bolt that works on the left side of


MR. GREENER'S FIRST ANSON AND DEELEY GUN.

the gun. This arrangement is exceedingly simple, and effectually bolts the triggers from behind.

I have no hesitation in saying that I most highly and thoroughly approve of this gun, and most strongly recommend it to my brother sportsmen.—(*Field*, Jan. 14, 1878.)

A safety blocking bolt on the same principle as that of Mr. Anson described at page 186, has recently been invented by Mr. Greener. It is acted on by the trigger in a similar way, and hooks on to a lump forged on the back of each striker (see page 188). Instead, however, of lifting out of gear it is worked inward by the arm which extends to the cross piece of the scear (Fig. 1), and is acted on contemporaneously like the

Scott and Westley-Richards, page 186. I am, as in the case of the Westley-Richards Company, pleased to be able to state that Mr. Greener is now more than half convinced of the necessity of a blocking bolt in addition to that on the trigger.

Several useful intercepting and trigger bolts have also been invented by other gunmakers as adapted to this action, which will hereafter be described under the head of Messrs.

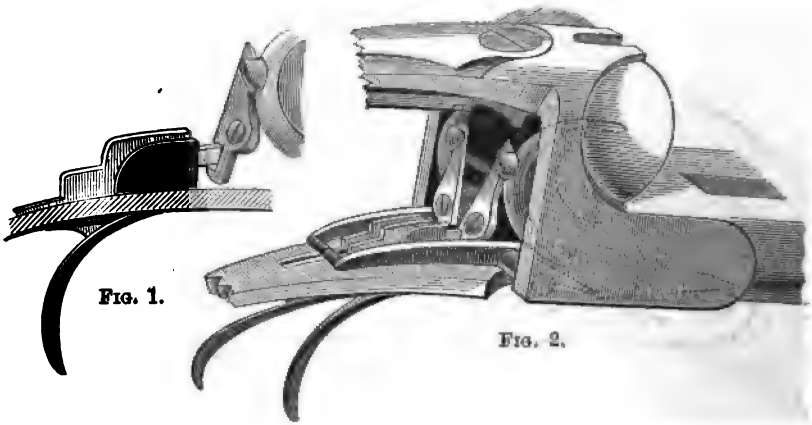


FIG. 1.

FIG. 2.

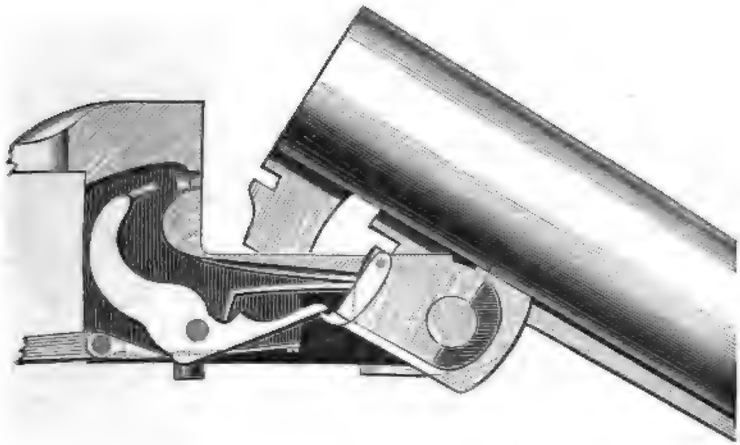
MR. GREENER'S INTERCEPTING BOLT, 1882.

Powell's patent, page 225, and that of Mr. Silver in Section IV. I may conclude this notice by stating that the Anson and Deeley lock maintains its hold on public opinion, and it would have had a still more general sale but for the high price charged, which is the more remarkable in that the work is not complicated, excepting that of the hinge bolt.

MR. GREENER'S IMPROVEMENT ON ANSON AND DEELEY'S ACTION.

This alleged improvement only slightly varies from that of Messrs. Anson and Deeley; the main alteration consists in the reduction of the friction between the cocking lever and the tumbler by substituting a swivel for the lever, the swivel being hung in the lump and catching the forward arm of the tumbler, which resembles that of Anson and Deeley—thus

On comparing this with the plan of the Anson and Deeley, it will readily be seen that a swivel is lodged in the anterior portion of the lump, with a hook raising the forward arm of the tumbler, and being substituted for the long lever of the Anson and Deeley. The friction is thereby reduced, and the leverage improved, so that the cocking is effected with less force. Rain is also better kept out of the locks. There is, however, some little practice required in putting together the



MR. GREENER'S IMPROVED COCKING SWIVEL.

gun when the barrels have been removed, but when this is mastered the improvement certainly is considerable in the facility of using the gun. In the engraving, the gun is represented without a cross bolt and top connection, but this is perfectly optional when selecting one, the necessity for a solid hinge bolt is also obviated.

### MESSRS. BLAND AND SON'S IMPROVED "FIELD" GUN.

In the autumn of the year 1878 I was so impressed with the dangers connected with the use of hammerless guns, when either unprovided with safety bolts, or with the inefficient ones to which I have already alluded, that I set about supplying

the deficiency to the best of my ability. As remarked at page 169, I had invented an automatically cocking hammered gun in 1866, which I discarded on account of the unsightliness of its projections; but it now occurred to me that the plan might be utilised for a hammerless gun in which the cocking projections would be concealed. Carrying out this idea, I thought that a strong intercepting automatic bolt might be combined with it, by making the cocking lump turn the bolt a quarter of a circle, and so place it at "safety" before the gun could be loaded, afterwards to be turned back again by moving an outside lever. The annexed woodcut shows this

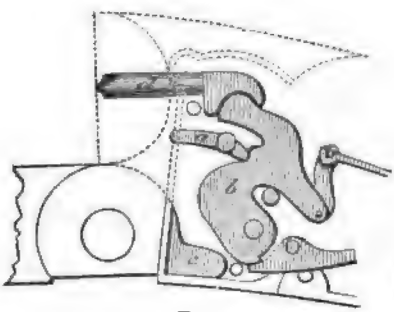


Fig. 1.

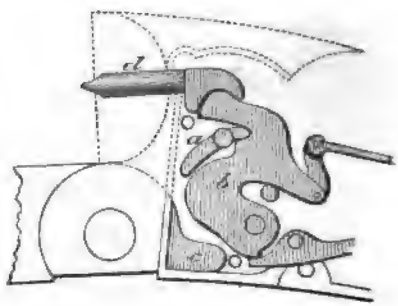


Fig. 2.

bolt (*a* Fig. 1), at safety, its little lever being turned up by the cocking lump *c*, and Fig. 2, in the firing position, when it allowed the tumbler to drive the striker *d* forward to explode the cap. Fig. 3 shows the lock as improved by Messrs. Bland. This plan seemed to me perfectly safe, and it has proved to be so, but, though I offered it to the trade generally, it did not find favour with them. Mr. Greener, of Birmingham, and Mr. Green, of Cheltenham, commenced its manufacture, but they did not go on with it, and left it entirely in the hands of Messrs. Bland and Sons, of Birmingham, who had from the first carried out my views with the greatest ingenuity and skill. The real objection to it is, that the action and lock are very expensive, and on this account even Messrs.

Bland have been obliged to resort to another plan for their cheap hammerless gun. After trying several improvements, the above enterprising firm finally adopted the following form and laid before me their first pattern early in 1880,

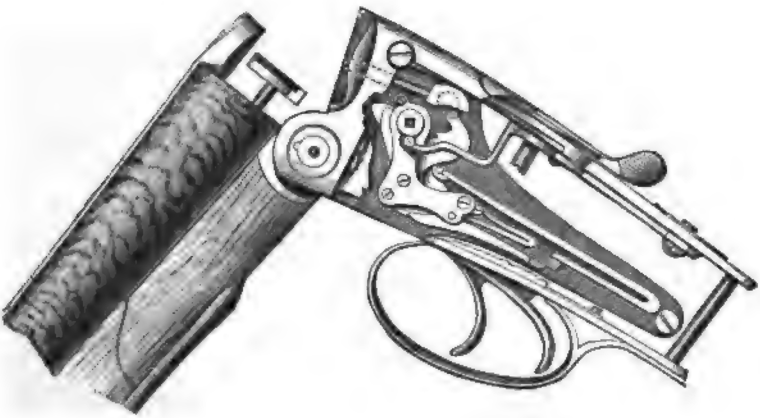


FIG. 3.—LOCK OF MESSRS. BLAND'S IMPROVED "FIELD" GUN.

which I described in the *Field* of March 6th in that year, in the following terms.

MESSRS. BLAND'S IMPROVED "FIELD" HAMMERLESS GUN.

Some weeks have elapsed since we promised our readers to describe the great improvements made by the above enterprising firm in the construction of the "Hammerless Gun," which we, about this time last year, delivered over in its crude state into the hands of the trade for manufacture. That interval has, however, been well employed by the firm in still further carrying out their reforms, and we think the final result, culminating in their last model—now visible at 106, Strand—may fairly lay claim to be considered perfect.

Our readers may remember that last year we only stated that, in our opinion, the desiderata for a hammerless gun were carried out by the one in question; but we did not put it forth as by any means in its highest state of development, there being one or two minor details in which it was deficient. Notably the repassing of the cocking lever over the breast of the tumbler occasioned a slight distress to the latter; but we hoped (and, as the result

proved, correctly) that the trade would find means to do away with this defect. So also with the lever, it was open to some objection; but, on the whole, we came to the conclusion that the principle is sound, and the conveniences connected with the fuller extraction of the empty cases so great as to outweigh the disadvantages. Now, however, that Messrs. Bland have done away completely with the latter, the gun offers itself on a completely new footing.

In the first place, the distress to the tumbler is wholly done away with, the cocking lever repassing against a concave surface instead of a convex one, this change of shape making a difference which must be felt to be appreciated. Secondly, the main bolt of

MESSRS. BLAND'S IMPROVED "FIELD" HAMMERLESS GUN.

the action is lowered by a top lever working sideways in the usual manner, with an ample "throw," and very smooth working, the wearing surface being greater than that of the "double grip." Thirdly, the safety bolts are now worked by a slide at the back of the top lever, being still self-acting, so that the gun must be loaded at safety;" but the change to "firing is so completely and rapidly under the control of the thumb, that no one ought to risk the danger incurred of loading at full-cock, if he has any regard for human life. Lastly, the extractor is worked by a single tooth, preventing all risk of putting the gun together with it out of gear.

We have thus described the improvements introduced by Messrs. Bland, for which they deserve the highest credit, and insert an exact engraving of the external appearance of the gun as now made.

A considerable number of these guns have been sold, and have given general satisfaction; but I do not conceive that it has the same claim for superiority of safety which I considered it entitled to in 1878, since there are now several perfectly efficient safety bolts for choice, as I shall hereafter show.

Moreover, the improvements made by Messrs. Bland and Sons had made it virtually a new gun, and, having recouped myself for expenses already incurred, I did not think it well to go on with the patent at the expiration of the first three years in the spring of 1882; and I am thus left free from any charge of bias in its favour, which might unfit me, in the opinion of many people, for my present task, as set forth in this work.

### Messrs. W. and C. Scott's Hammerless Gun.

During the same year, 1878, in which I was thus engaged, Messrs. Scott, of Birmingham, who are among the largest wholesale firms in that centre of the gun trade, were engaged in bringing out a rival of the Anson and Deeley action, including in it their most ingenious safety bolt. I was not aware of this, or I should not have troubled myself in the matter; and when I showed Mr. W. Scott my plan, in its early stage, he did not give me the information which would have had its due effect on me in that direction. Mainly by my efforts in the columns of the *Field*, well aided by them as manufacturers, automatic safety bolts have now become the rule, and comparatively few hammerless guns are sold without them either on the triggers, or as intercepting blocks, or both.

The cocking plan of Messrs. Scott's gun so closely resembles that of Anson and Deeley that an action was speedily brought by the latter against them, but it resulted in a verdict being given in favour of the alleged pirates. The difference consists in the method by which the tumblers are cocked, both being acted on by the fall of the barrels. In

the Anson and Deeley a lever connected with the fore-end tilts up a projection from the tumbler, while in the Scott gun a rod in the same situation is hooked to the tumbler, and is made to draw it up by another hook cut in the lump. If the annexed woodcut is compared with that illustrating the Anson and Deeley gun, at page 183, the difference between them will be readily seen.

In the Scott action, as illustrated by the following

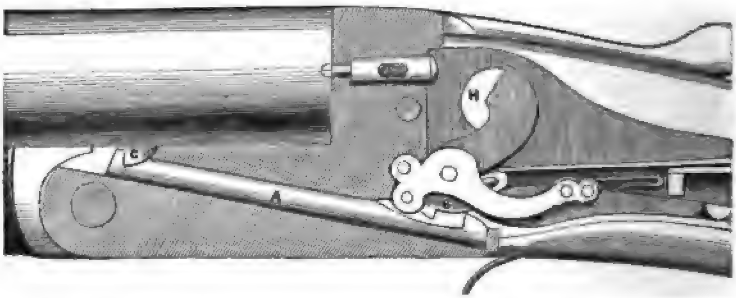


FIG. 1.—PLAN OF MESSRS. SCOTT'S ACTION, SHOWING COCKING ROD, WITH GUN CLOSED (two-thirds size).

engravings the rod A connects the hinge joint at C with the tumbler B. At each end is a hook which at the hinge joint is driven forwards by a corresponding projection C, readily seen.

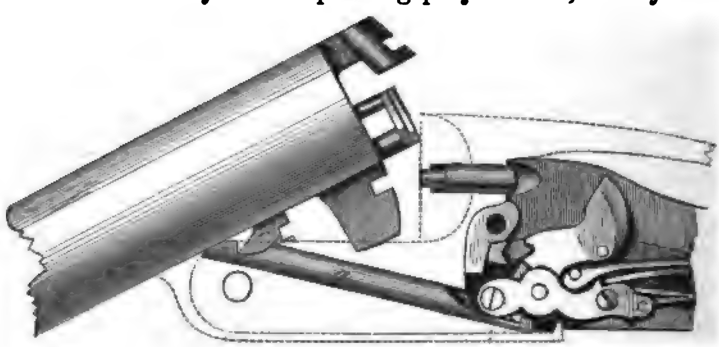



FIG. 2.—PLAN OF MESSRS. SCOTT'S ACTION OPEN.

Fig. 2 shows the action opened and the tumbler raised to

full cock, which is visible from the other side through the transparent indicator H, the rod being driven back clear of the tumbler by the revolution of the hook *c* on the lump in Fig. 1. When open, as shown in Fig. 2, the rod *a* bears on the notch *b* in the tumbler after it has raised it to full-cock. The bolts are either the Purdey, by itself, as in Fig. 3, or united with a


FIG. 3.—MESSRS. SCOTT'S PREMIER HAMMERLESS GUN.

top connection and powerful hook, the latter forming one of the strongest actions in existence, and suitable for express and heavy rifles as well as guns of 8 and 4 gauge.

But the lock of this admirably designed gun is altogether different from the Anson and Deeley, the limbs being on a lock plate, and not lodged in the action, so that the latter is of full strength, only being bored for the cocking rod. Unfortunately for Messrs. Anson and Deeley they were not aware of my 1866 gun, mentioned at page 169, and they rested their patent right on the principle of cocking by the fall of the barrels. Now as I had clearly anticipated them in this point, their claim to its sole use under their patent of 1874

could not be maintained. The patent of Messrs. Scott, on the contrary, depends on the exact means by which the tumbler is raised, and, though any one may use the fall of the barrels as the force by which the tumbler is raised, they cannot use Scotts' special hook for that purpose, nor can Scott or any other person use the lever of Messrs. Anson and Deeley in the form described by them, without the permission of the respective patentees. Fig. 3 gives the external appearance of this excellent gun.

In comparing this gun with the Anson and Deeley, it is often alleged that in the former the fixing of the tumblers in slots cut in the action is stronger than when placed in the old-fashioned way on a lock plate, but I confess I cannot see this, and I greatly prefer the lock plate with the swivel to the spring. But when the Scotts' safety bolt is taken into consideration, the balance is completely turned in favour of the Scotts' gun as a whole according to my judgment. Their safety bolt is of a most ingenious construction, the nature of which will be rendered apparent on examining the annexed plans in which Fig. 1 represents the lock at full-cock; the pressure of

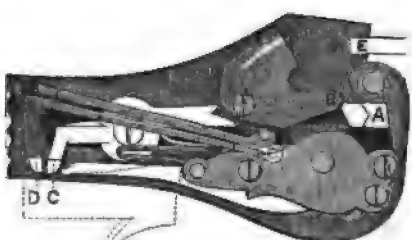



FIG. 1.

the trigger on the tails C and D of the safety block and scear raises them, and, *pari passu,* lowers the projection A, allowing the direct blow of hammer on the striker E.

Fig. 2 shows what takes place when the tumbler has at full cock been lowered by the scear having been jarred out of the bent. The breast of the tumbler at B is then caught on the

projection A which remains in its place, and prevents the tumbler from reaching the striker E.

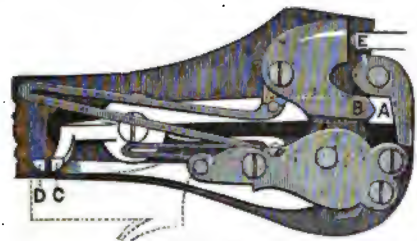



FIG. 2.

Fig. 3.—The lock is here supposed to have been pulled off *by the trigger* in the legitimate way, and the hammer is in

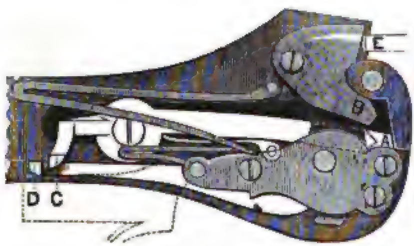



FIG. 3.

contact with the striker E, the safety block A having been removed out of the way of the falling hammer by the simultaneous pressure of the trigger on the tail of its lever at C.

Nothing can act better than this safety bolt, and in addition an automatic bolt and slide of the usual construction are attached, locking the triggers, so that the gun is always safe until the trigger is pulled; and this cannot be done till after the trigger safety bolt has been pushed to "firing."

This gun is sold by various gunmakers in London and the provinces, either as made by Messrs. Scott or under royalty from them, and was first brought to my notice in October, 1879, by Messrs. Holland and Holland, of New Bond Street, who manufacture it under a royalty from the inventors. The result was the following report, which appeared on Oct. 25 in

that year, and which subsequent experience has fully confirmed.


Fig. 1.—Messrs. Holland and Holland's Climax Safety Hammerless Gun.

Most sportsmen have at one time or the other seen the accidental explosion of guns in consequence of some fall or blow received by the guns, the locks of which have become kittle (*i.e.*, light in the pull off), probably through the weakness of a scear spring, or from the scear axle becoming rusty, or from some other cause.

With the "Climax Safety Hammerless" such an accident cannot possibly occur while the intercepting bolt is unbroken; the hammers of the locks can never reach the cap of the cartridge, unless the triggers are pulled, there being a self-acting block always in position in front of the hammer, and interposed between the hammer and the striker, which block can be removed by pulling the trigger, and in no other way, while the triggers themselves are locked until the automatic safety is pushed forward.

The setting out of the locks is so arranged, that before the scear can be pulled out of the tumbler bent, and the hammer allowed to fall upon the striker, the trigger will have lifted the short arm of

the safety bar far enough to clear the block out of the way of the fall of the hammer. (See pages 196, 197.)

The advantages claimed for this gun are:

1. Absolute security, not only when the locks are bolted, but even when placed at full cock ready for discharge.

2. A perfectly sound and secure connection, having the top lever with a double bolt grip under the barrels, and, when desired, a third grip formed by the lever engaging into the extension of rib, which extension beds into the top of the action; thus forming a treble grip, and making the action strong enough to stand the heaviest charges. (See Fig. 2.) The two bolts are here shown in white.

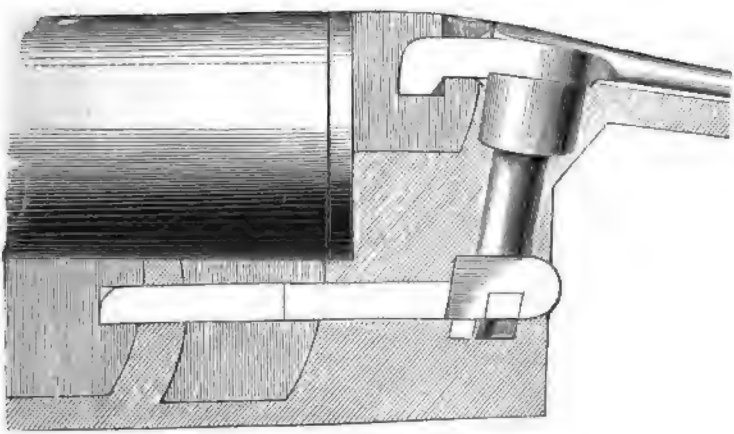


FIG. 2.—BOLTS OF AN 8-BORE CLIMAX HAMMERLESS GUN (full size).

3. The locks are very simple in construction, and are upon the same principle as an ordinary side lock; they can be taken off and cleaned in the usual manner and repaired, or any of the limbs replaced by an ordinary workman.

4. The top safety, which locks the triggers, is made automatic or not, as desired, and is so arranged that the wood of the stock is not weakened.

5. The pistons which raise the tumblers to full cock, being under cover and fitting into circular holes, there is no chance of water being able to penetrate into the locks through this connection, usually a weak point in hammerless guns.

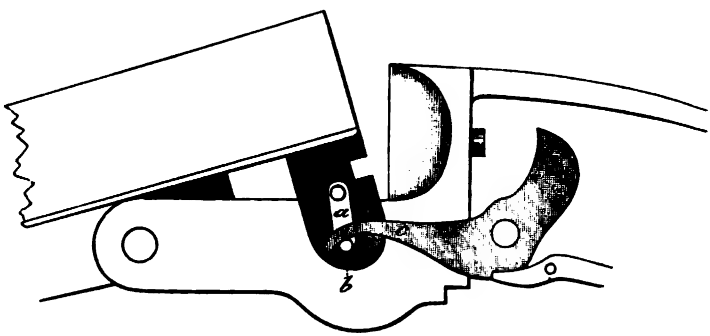
6. The impossibility of the jar given by explosion of one barrel

firing off the lock of the second barrel, a point often referred to by sportsmen when using very heavy charges.

7. The ease with which the gun can be opened, and locks raised to full cock, as compared to the force required to be exerted to open many of the hammerless guns now before the public.

### Messrs. Gye and Moncrieff's Hammerless Gun.

Another alleged piracy of the Anson and Deeley action was patented by Mr. Gye, of St. James-street, soon after Messrs. Scotts' was protected. It still more closely resembles it than theirs, but the result of the legal proceedings against Messrs Scott forbad any further prosecution of the claim, and it, in

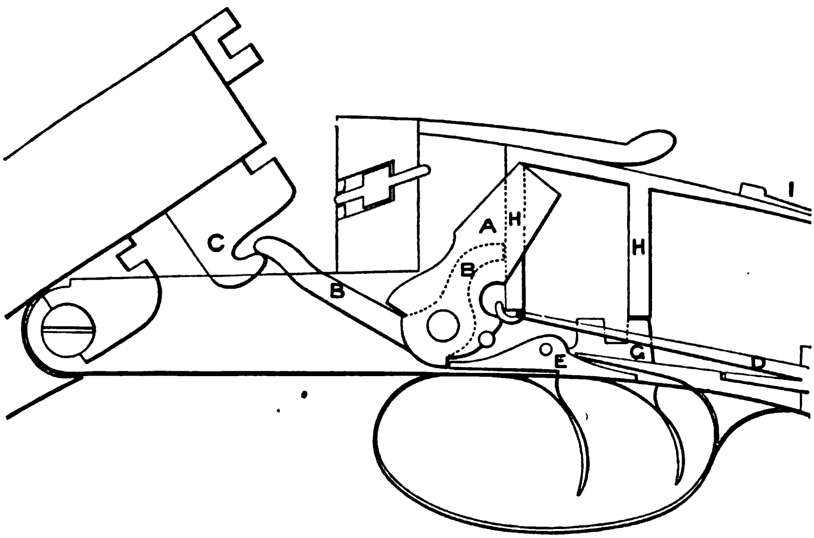


Messrs. Gye and Moncrieff's Hammerless Action.

common with several others, must now be considered to be fully entitled to its share of public patronage. Mr. Gye's method of cocking is perhaps the simplest of all, except perhaps my own original one of 1866, consisting in hinging a swivel *a* on each side of the lump, with a stud *b* which, as it rises with the lump, lifts a projecting limb *c* of the tumbler to full-cock. The objection to this plan is that it causes a somewhat unsightly lump just in front of the trigger-guard, but to this is replied that the cocking is rendered comparatively easy, and pleasant to the hand. The plan is no doubt extremely simple and efficient, and as to the lump, sportsmen can judge of its appearance for themselves.

## Messrs. Lang's Hammerless Guns.

This firm was so completely identified with the introduction of the Lefaucheux breechloader into England, that it might be expected to continue in the same path, and naturally Mr. Lang (son and successor of the late Mr. W. Lang) has devoted himself to the keeping up the reputation gained by his father's skill and energy. With this view, he brought out, about the year 1877, his first hammerless gun, which was like those I have already described, a very close copy of the Anson and Deeley, as will at once appear on comparing the annexed plan with that at page 183.




Messrs. Lang's Hammerless Gun, No. 1.

In the Lang gun the tumbler is separate from the striker, but the method of raising it to full-cock by means of the lever B, acted on by the lump C, is exactly the same in principle as that of the Anson and Deeley, though the shape is varied, and the tumbler has no horizontal limb, but is driven back by pressure on a projection from its side as in the Gibbs and Pitt

lock. In this gun, the safety bolt is a slide locking the trigger G and mainspring D at H H. The action is the usual Purdey bolt and top lever, but this gun is not now made.

Their next improvement was the following, which is I think an excellent gun. It was devised to meet the possible result of the Anson and Deeley *v.* Scott action, in favour of the plaintiffs, which would probably have involved Messrs. Lang in the same way. Annexed is an engraving of this gun (Fig. 1), together with a plan of its working parts (see Fig. 2).

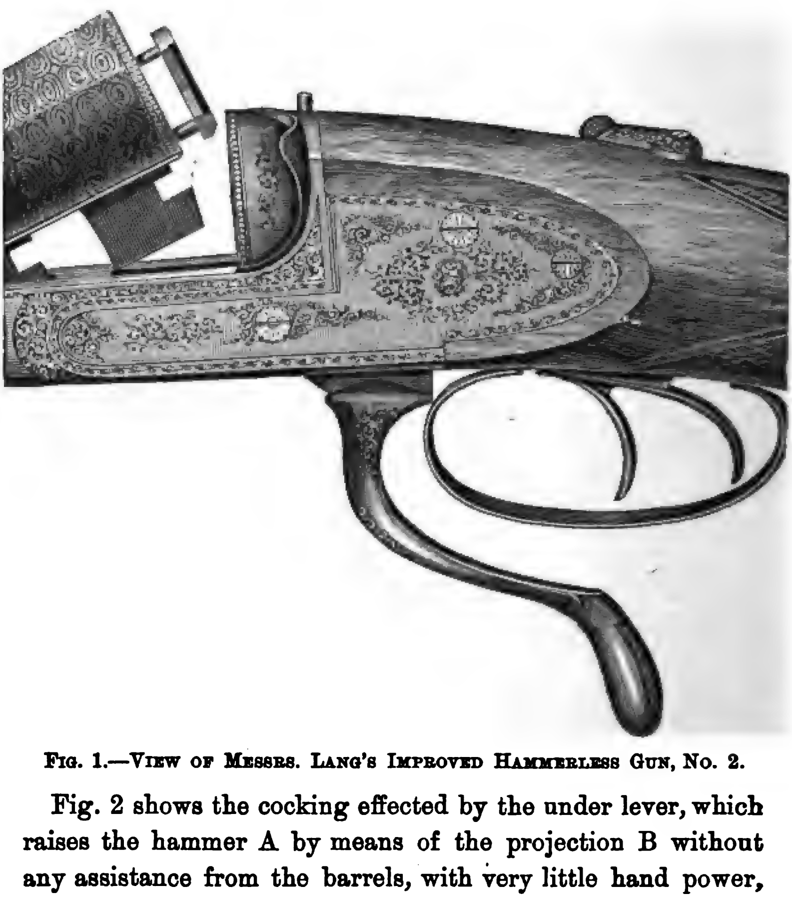


FIG. 1.—VIEW OF MESSRS. LANG'S IMPROVED HAMMERLESS GUN, NO. 2.

Fig. 2 shows the cocking effected by the under lever, which raises the hammer A by means of the projection B without any assistance from the barrels, with very little hand power,

and with the great advantage that no water is admitted to the locks when the gun is opened. The locks are fitted on the

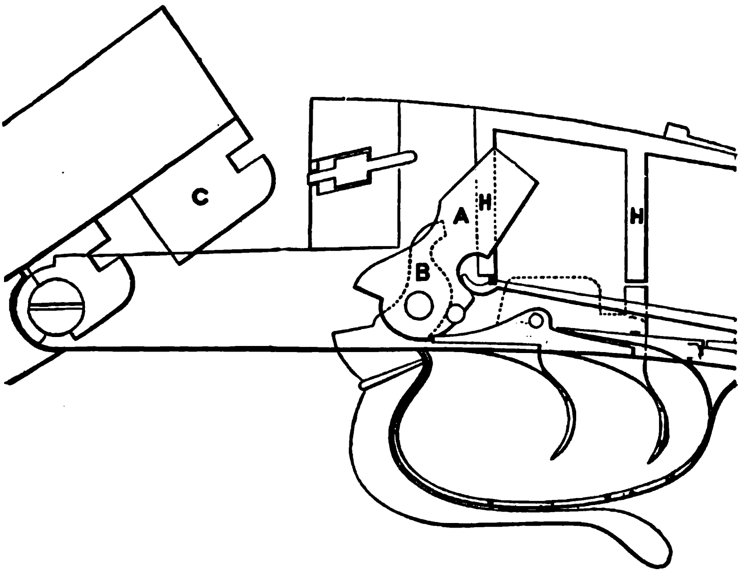



FIG. 2.—PLAN OF LANG'S GUN, NO. 2.

trigger plate, but sham lock plates of the bar shape (see Fig. 1) take off by the usual side screws, and are let into the action,

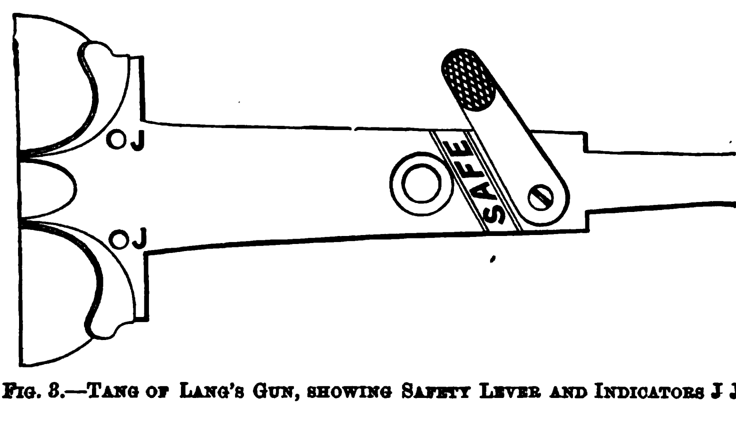



FIG. 3.—TANG OF LANG'S GUN, SHOWING SAFETY LEVER AND INDICATORS J J.

not only without weakening it, but even adding to its strength by splicing it with the wood of the stock. For this reason, being virtually a back-action, no top connection is required, and the Purdey bolt only is used. The safety bolt H H is the same as that described in Messrs. Lang's first gun, and is worked backwards and forwards by a short lever in the tang, as shown in Fig. 3.

Recently Messrs. Lang have made a third improvement, by which their first action, shown at page 201, is made to cock the gun by pushing back a bolt from the hinge to the breast of the tumbler, instead of raising it by means of the lever therein described. In other respects the gun is similar to it, and has a very neat external appearance; but I prefer his No. 2.

### Woodward's Automatic Patent Hammerless Gun.

About the year 1877 Messrs. Woodward, of St. James-street, London, submitted to me their adaptation to a hammerless gun of the automatic action described at page 172. The following is the description of it given by the inventors:

One of the numerous advantages is that the same locks and action are used as in ordinary bar guns, with the exception that the hammers are inside instead of out, in other respects the outlines are precisely the same. The hand lever centred on the trigger plate has a lifting bar (Fig. 2, *a*) hinged to it, which bears on the arms projecting from the tumblers *b*. It raises the locks, and at same time moves a safety bolt *c d* over the ends of the triggers at *e*, and one in front of each hammer, so that should the lock be jarred off by a fall, the safety bolt in front of the hammer would catch it in the throat immediately at starting, rendering it impossible for any accidental explosion to happen. The construction of the lifting bar, hinged on the hand lever, is so arranged that very little force is required to raise the locks, consequently the same weight mainspring can be used as in a gun with outside hammers, avoiding any chance of missfires so often complained of in hammerless guns.

In this gun the triggers are locked as well as the tumblers, and under the head of "Silver's safety bolt" an adaptation of

that invention to this automatic gun will also be found. I am happy to state that, though there is externally an appearance

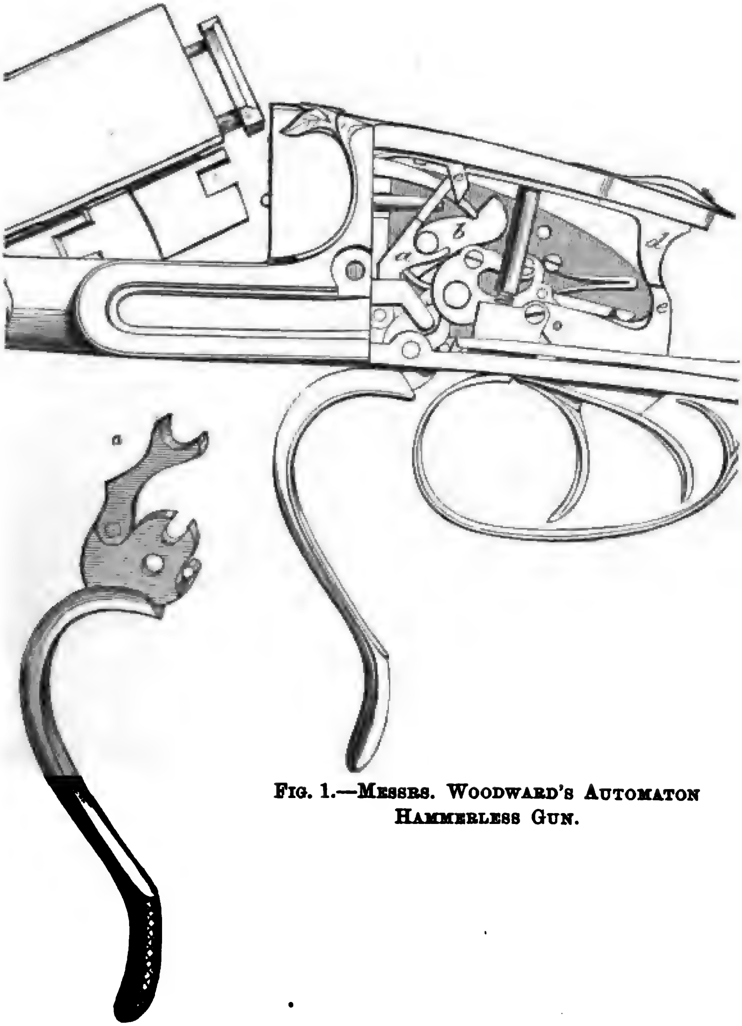


FIG. 1.—MESSRS. WOODWARD'S AUTOMATON HAMMERLESS GUN.

FIG. 2.—LEVER DETACHED.

of a bar lock, this is not real, and that, as in Messrs. Lang's gun, the action is not cut away, so as to render a top con-

nection necessary. Indeed, as far as this part is concerned, the gun is as if it had the back-actioned lock, which in reality it has, and the bar plate introduced adds to the strength of the stock by acting as a splice between it and the action.

### Mr. Tisdall's Patent Hammerless Gun.

In the year 1880 Mr. Tisdall, of Birmingham, exhibited to me a cheap form of the hammerless gun, being at the low price of 12 guineas, which at that time was unheard of.

The annexed cuts illustrate in a clear and comprehensible

Fig. 1.—Mr. Tisdall's Hammerless Gun (Open).

manner the special characteristics of this gun. Among the advantages peculiar to it I may mention, first, the simple arrangement of the limbs employed in opening and cocking the gun; these consist of but two, viz., the lever and bolt. Pressing the lever with the thumb from left to right withdraws the bolt, throws the safety bolt into position, full cocks, and opens the gun at the same time; and although the whole of the work is done by the lever, it is one of the easiest top-snap hammerless gun to cock in existence. Secondly, the arrangement and effect produced by the safety bolt, which is

automatic or not at the will of the sportsman. The skeleton drawings (Figs. 2, 3, 4, 5) will explain the working of the safety bolt (Fig. 4), which takes its bearings in the lock plates in front of the tumblers. This bolt is acted upon by a small projection on the bottom of the locking bolt of the action (Figs. 2 and 3, *f f*), and is provided with a small lever outside the right-hand lock plate for moving the safety bolt or bar by

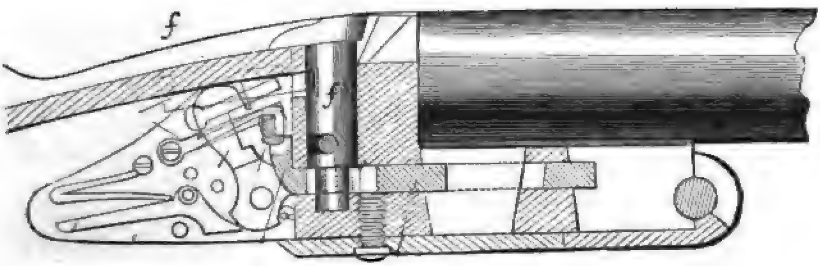



FIG. 2.

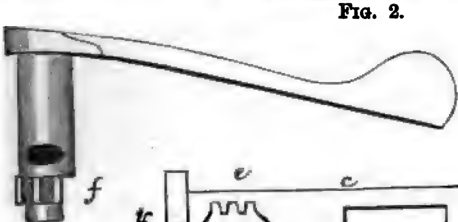



FIG. 3.

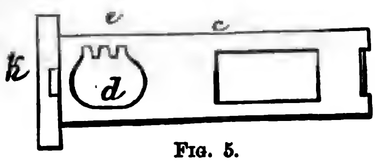



FIG. 5.

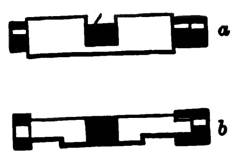



FIG. 4.

hand (see Fig. 1). The safety bolt is turned into the safety position automatically on cocking the hammers; and, before the gun can be discharged, it is necessary to turn the safety bolt by its small external lever into its vertical position, when it permits the hammers to fall upon the strikers. If it is wished to put the safety bolt in such a position that it cannot be acted upon by the sliding bolt, the said bolt is turned through a semicircle from its first described or vertical position; that is, it is inverted so as to bring that edge of the bolt which was uppermost (*a*, Fig. 4) undermost, as at *b*. By this change

of position of the safety bolt, the open edge of the recess in the middle of the said bolt is brought opposite the stud on the sliding bolt (Fig. 5), and the said stud on the sliding bolt, making its back movement, enters the open edge of the recess, but does not operate on the bolt.

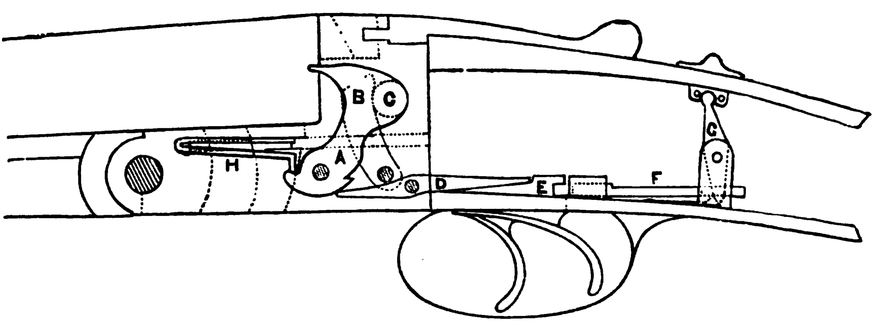
Fig. 2 represents the gun in longitudinal vertical section, the hammers being represented cocked, and the safety mechanism in position to permit of the fall of the hammers.

Fig. 3 represents in side elevation the top lever of the gun, and its pinion *f* for withdrawing the sliding bolt.

Fig. 5 represents the sliding bolt detached. At the rear end of the bolt *c* is an opening *d*, and on one side of the said opening a short toothed rack *e* is formed for the pinion of the top lever (Fig. 3) by which the bolt *e c* is withdrawn to unfasten the barrels.

### Mr. Walker's "The Umpire" Hammerless Gun.

About the same time I noticed the Umpire gun sent to me by Mr. J. G. Brunn, Sand-street Works, Birmingham. The




Section of the Umpire Gun Patented by Mr. Walker.

cocking is effected by a top lever in the ordinary manner. The side lock is entirely dispensed with, and the cocking arrangement, which is inclosed in the head of the action, is remarkably strong, and admits of the stock being left quite

solid, leaving an excellent sound head. In the engraving on page 208 A shows the tumbler and striker combined in one, as in the Anson and Deeley; B, the cocking lever, worked by the agency of the top lever in such a manner as to impinge on the projection from the side of the tumbler at C, and raise the latter to full cock. D is the scear, E the trigger, F the trigger bolt, moved (optionally only) by the slide G. The mainspring H exactly resembles that of the Anson and Deeley lock in shape and position. Indeed, the whole of the arrangement, excepting the cocking, are almost identical with that well-known plan. On comparing the two my readers can judge for themselves between them. My own impression is, however, certainly adverse to the Umpire, as being inferior to its prototype, instead of being an improvement on it.

### THE "ACME" HAMMERLESS GUN.

Early in the year 1881 several correspondents of the *Field* noticed in highly favourable terms a new action under the above

FIG. 1.—WOODWARD'S ACME GUN IN POSITION FOR FIRING, WITH INDICATORS.

title. It is patented by Mr. F. B. Woodward, gunmaker, of Birmingham, and sold in London by Messrs. Beattie and Co., of King William-street, E.C. The action is an ordinary

snap, without loss of metal at the angle, so that no top connection is rendered necessary in point of safety; and the lock plate, as in the Automaton and Lang's guns, is only a splice to give strength to the stock. The striker acts directly on the cap by means of a spiral spring, and though I certainly prefer

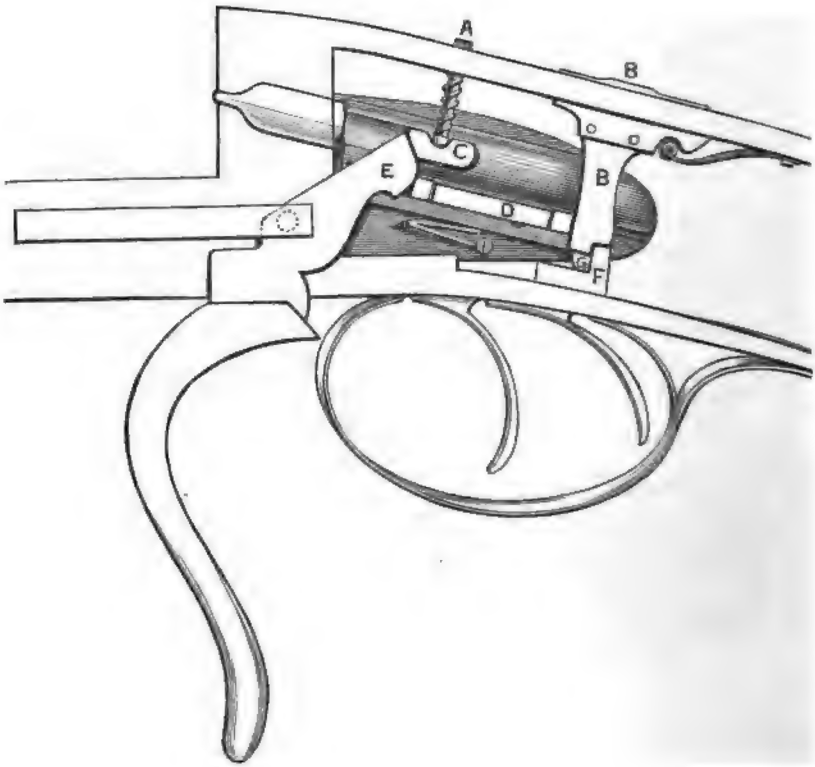



Fig. 2.—The Internal Construction of the Acme Gun.

a flat one, this being a very long spiral is of the least objectionable form.

In the annexed plans A is the indicator; B, safety bolt; C, plunger; D, slide that works safety bolt; E, lever; F, trigger; G, scear; H, scear spring; I, main spring; J, striker.

By depressing the lever the plunger C is carried back to full-cock, and the indicator A raised; at the same time the slide D pushes the safety bolt B across the scear G and trigger F, effectually locking both *before the barrels can drop.* With the safety bolt in this position it is impossible to release the plungers, no matter how light the locks may pull.

On the top of the gun in front of the safety bolt is the word "safe," which indicates to the user that the safety bolt is in the locked position, but it is only on the triggers and scear.

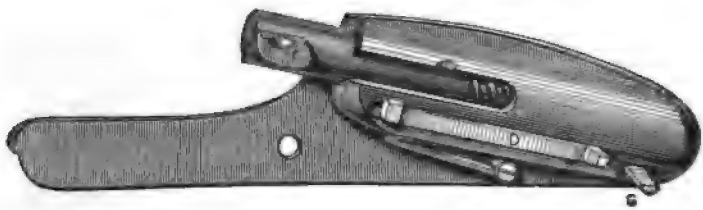



Fig. 3.—The Lock Complete.

After discharging one barrel the other can be secured without re-cocking the gun, nor is it necessary to disturb the bolt from "safety" before re-cocking. Having tried this

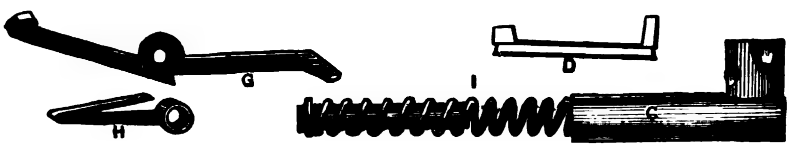



Fig. 4.—Limbs of the Lock.

lock to a certain extent, I am better satisfied with it than I expected, but I prefer the flat spring, and must condemn the absence of a blocking bolt.

### Messrs. Rigby and Bissell's Improved Hammerless Gun.

It is needless to describe the early stage of this gun; for very soon after the plan was patented its improved form was brought before me in January, 1872, when I had just abandoned the patent of the *Field* gun, and announced that I was

in consequence prepared to criticise new inventions in the way I adopted before I felt my hands tied in 1879. I therefore introduced it in the following terms, which I give *in extenso.*

Those of our readers who are devoted to shooting have most probably noticed that for the last three years we have studiously refrained from giving any opinion upon the construction of the numerous guns which have been in the market during that time, although repeatedly asked to do so by our correspondents. This has been caused by our feeling that we could not be considered as perfectly impartial while we were offering to the public a gun in which we were pecuniarily interested; although we might claim that the amount of that interest was so small as most probably to weigh very little with our friends and supporters. That interest has, however, now ceased, and we shall henceforth tender our advice in these matters to the same extent as of old.

It happens, moreover, that the first new action which we proceed to criticise is constructed mainly on the lines which we laid down in the spring of 1879, and on which we held a controversy for some time with our valued friend Mr. John Rigby, who is the joint patentee of it with Mr. Bissell, a well-known and skilful London action-filer and barrel-maker. In this action, which is an improvement on the one described by the inventors in the *Field* of March 26, 1881, all our ideas, as then propounded, are carried out to the fullest extent, and to a great degree on the principles which we embodied in the gun, then first laid before the public—notably in the top connection upright bolt and in the safety bolt; and we are not a little proud of this practical proof of the influence of our arguments on so strong a controversialist as Mr. Rigby. The following are the principles on which we then insisted as necessary to the production of a perfect hammerless gun:

1. A sufficient strength of action, which in our opinion, as then expressed, can only be carried out in bar-actions by a top connection between the barrels and the break-off. In back actions the "prong" is not reduced in strength to admit the bar-lock and its mainspring, and may be relied on, if made of good metal, not to spring at its angle with the body. This weakness of the bar-lock action we proved by experiment, as published in the *Field* of May 25, 1878. To a certain extent it is provided for by the "doll's head" without any bolt, now commonly used; for though

it will not keep down the barrels when fired, it will when they are otherwise kept down prevent the strain on the angle above mentioned, because it in so far acts as if the joint was at the angle instead of an inch and a half or more further forward. In Mr. Rigby's gun the action is as strong as, or even stronger than any of its rivals, the barrels being kept down by the well-known Purdey bolt, and the spring at the angle prevented by a top connection, into which travels upwards a perpendicular bolt, similar to that designed by us, but improved upon in a very simple manner by leaving the metal of the break-off intact between it and the barrels, by which it is as well supported as if it were a part of the action itself; and, moreover, its size may be reduced in a proportionate degree, thereby leaving more metal in the top connection projecting from the barrels. This bolt and also the Purdey bolt are acted on by a lever of the ordinary construction lying below the trigger guard, which also cocks the tumblers, and automatically makes "safe" the safety bolt. Here, therefore, we have all the principles we contended for carried out, and, as the force required to lower the lever is very small, there is no unpleasantness in opening the gun, but the reverse. Three years ago no hammerless gun then invented could be so described—the "Anson and Deeley," which we then considered the best, requiring considerably more force, while it has also the disadvantage of straining the Lefaucheux hinge (weakened by being cut in half) by the drop of the barrels.

2. The construction of the lock as regards safety, chiefly determined by its safety bolt.

Here the gun under consideration is, in our opinion, quite unexceptionable, being provided with a safety bolt similar in principle to our own, but acted on automatically by the forward fork of the lever (which also lowers the top bolt) instead of by the barrels. With the Lefaucheux hinge, when it is done with so little force as in this gun, we consider this an improvement, because the straining of that hinge, as above mentioned, is thereby avoided. The top lever is by many persons now regarded as a *sine quâ non*, but, except when it is required to move the top bolt sideways, as in the Greener and Westley-Richards guns, we certainly prefer the lever under the guard, as being more handy, and tending to lower the stock after the bolts are released. As to the safety bolt itself, it is perfect, presenting a strong block to intercept the tumbler if it is jarred off the scear, which is the main desideratum in a safety

bolt. There are, however, two minor points also to be provided for—first, that if the tumbler is let down on "safety," the cap cannot be exploded by turning the blocking bolt; and secondly, that in such case there shall be no necessity for opening the action to re-cock the gun. The first of these is provided for by leaving a small "nib" on the bolt preventing the accident referred to, while the second is avoided by the bolting of the triggers themselves. Lastly, if one barrel is discharged the other can be bolted by moving the slide, which is in the place now ordinarily adopted for it in the tang of the break-off. Altogether, we consider this the best safety bolt we have yet seen, and, being entirely fitted under the tang, and unconnected with the lock, except where it touches the bolt, it is more easily fitted by the workman. The lock itself is an ordinary bar-lock, differing only in the shape of the plate, and in the form of the tumbler, which has a projection inwards to receive the prong of the lever by which it is worked.

3. In its manipulation this gun does not differ from the best forms of the modern breechloader, and as to its balance, weight, and appearance, it is sufficient to say that it does great credit to its inventors.

4. In the exclusion of water and explosive gas from the lock and action there is nothing to be desired, the only channels by which either can enter being well fitted, namely, the striker holes and the slot for the Purdey bolt. The strikers are introduced from the front of the break-off, and, when driven back, present a shoulder to cut off the gas if any of this destructive agent escape from the cap.

5. In freedom from wear and tear the gun is good, the Purdey bolt being, if worn away, easily replaced by a larger one, while the same can be done with the top bolt.

With regard to the stock, it is of course cut away a good deal to receive the safety bolt, but not so much as in most hammerless guns, there being a fairly good head left for screwing together, while the lock plates are so securely fixed to the break-off as to greatly increase its strength, and prevent the liability to give way in case of a fall or blow, which is so often complained of.

The annexed engravings fully explain the mechanism of this gun:

Fig. 1 is a skeleton view of the action and right lock, the left

being removed; C is the slide locking the triggers, and moving to "safety" or otherwise the transverse bolt D D.

FIG. 1.—MESSRS. RIGBY AND BISSELL'S HAMMERLESS GUN (two-thirds size).

Fig. 2 shows the vertical bolt A; and B the portion of the break-off left intact, so as to support the bolt.

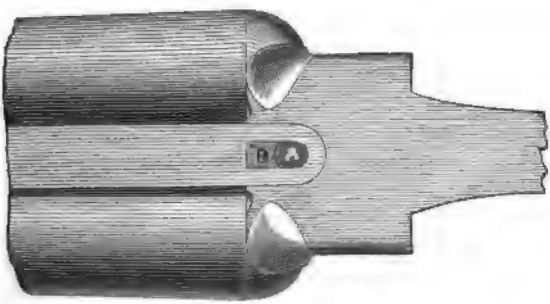



FIG. 2.—TOP CONNECTION AND BOLT.

Fig. 3 gives a detailed view of the several parts of the action, and of the trigger plate and safety bolt. A the lever, with swivel for the spring G; B the Purdey bolt, worked by the claw of the lever; C is the safety slide, working on the square shown in the

middle of the safety bolt D; E the thumb-piece attached to the slide C; F a triangular cam, worked by the lever; the horizontal limb is inserted in a slot cut in the top bolt (shown in Fig. 5), which

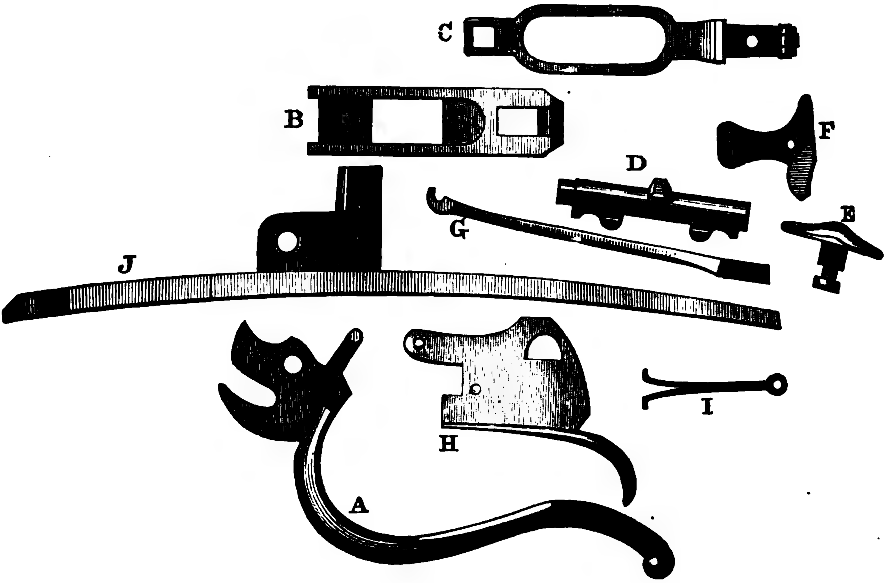



FIG. 3.—BOLTS, TRIGGER, AND LEVER.

it raises or lowers, as the case may be; the lower limb is acted on by the fork of the lever, while its upper limb automatically brings the intercepting bolt to "safety," leaving it there free to be moved

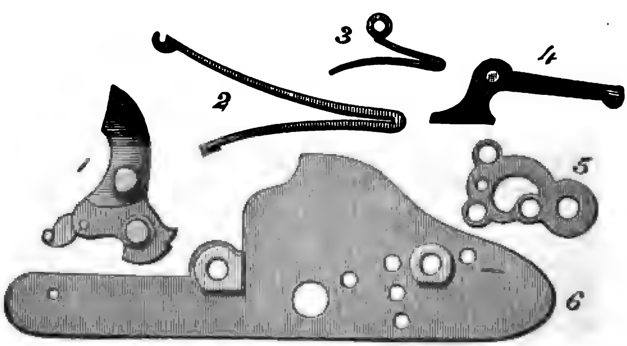



FIG. 4.—LOCK PLATE AND LIMBS.

by the slide when so desired; G is the lever spring; H the trigger; and I the trigger-spring.

Fig. 4 shows the tumbler and swivel, to which is attached the mainspring (2); (3) is the scear spring; (4) the scear; (5) the bridle; and (6) the lock plate.

Fig. 5 gives a view of the top bolt A; also B C, the striker and screw, of the usual form for introducing from the front of the

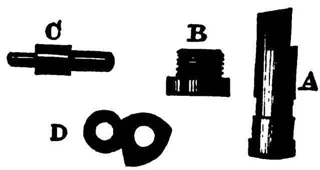



Fig. 5.—Top Bolt and Striker.

break-off. D is a small plate, by which the intercepting bolt is firmly secured in its place.

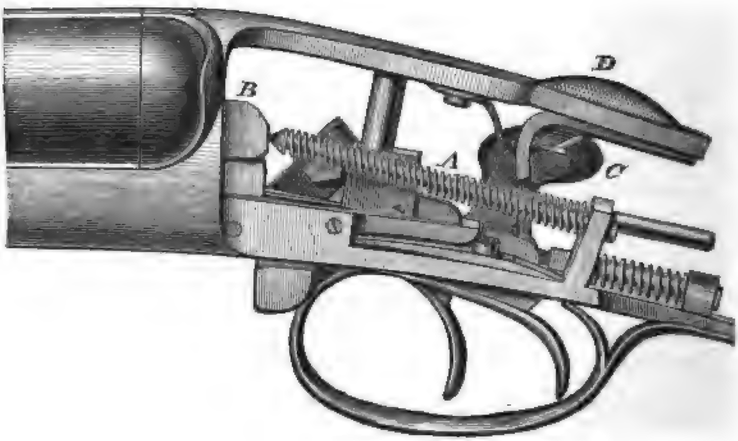
These are all the pieces of this ingenious piece of mechanism, with the exception of the screws by which they are secured.

### Mr. Grant's Hammerless Gun.

In the spring of 1872 I reported on Mr. Grant's gun in the following terms, and though I gave considerable offence to some of his customers, who alleged that they had used it without accident, I have seen no reason to alter my opinions therein expressed.

Mr. Grant, the fashionable gunmaker of St. James's-street, is so well known for his practical knowledge of the gun trade, that we confess our surprise is considerable on examining the gun which for some time he has been recommending to his customers. Unlike most of his "West-end" competitors, he has not given way to the rage for bar locks in the breechloading hammer guns which have gained him of late years the high position occupied by him, and for which we have always given him credit. This caution against accident is also carried out in his hammerless gun, but beyond this good point we regret that we see little to recommend it. The action itself is an ordinary "snap," without any "top connection;" but this is not needed, as the angle in the break-off is not cut away for the bar. In the gun submitted to us the lever is placed

on the right side (see engraving C); but this is a mere matter of fancy, and it may be under the guard, if so desired. We have therefore, as a novelty, only to examine into the safety bolt and lock. 1. As to the safety bolt (D), it is automatic, being driven to safety by a spring rod worked by the lever; but it only bolts the triggers, and has no intercepting block whatever. Consequently, it merely prevents the accidental pull of the trigger, and does not pretend to guard against the jarring of the scear out of the bent during loading, or from any other blow to the gun. Mr. Grant alleges that in a well-made lock, which his undoubtedly is, such an accident is impossible; but those who use his gun should, at all events, know that it has often occurred, and that they are liable to




MR. GRANT'S NEW HAMMERLESS GUN (two-thirds size).

the same risk as in the old days of muzzle-loaders when loaded at full-cock, which, experience tells us, sometimes led to the loss of a finger and thumb, or, indeed, of the whole hand. Indeed, this risk is greater in Mr. Grant's lock, because, instead of the shooter blowing off a part or the whole of his own hand, he is liable to receive a charge in the back from the hand of his loader. But, beyond this general liability to jar off, we have also to consider whether or no in this gun the lock is specially framed so as to reduce this danger to a *minimum*.

2. The lock is an ordinary one as far as the tumbler, striker, scear, &c., are concerned, the former being raised by the lever to full-cock with very little force. But, instead of the flat main-spring, a rod (A) is made to impinge on the head of the tumbler

(B), on which it is driven by a very long spiral spring. In our engraving the right tumbler is shown at full-cock, the rod being brought back and the spring compressed. The left tumbler is down on the striker, showing the point of the rod bearing on it with as little friction as is possible in such a contrivance. But we are entirely at a loss to discern any single point in which this plan is superior to the flat mainspring, except on the score of less cost of replacement when broken, which is so far an advantage, the spiral spring costing only 1*d.* or 2*d.* Undoubtedly, Mr. Grant has made his spring so long that it is not open to the same objection as a short one; but we think that, *cœteris paribus*, few practical men will hesitate in preferring a flat to a spiral spring. In addition, there is no special provision against the admission of gas, the strikers being without shoulders; and if once this is admitted, the spiral spring would, we fear, soon drag and spoil the detonation, followed by a fracture, which, however cheaply it may be replaced, is itself an event to be deplored; and, moreover, the bent would rust, and also become foul, tending to produce the "jar off" to which we have alluded above.

3. The locks being built on the trigger plate, there is plenty of wood left on each side, and in this respect the gun is strong and good.

On the whole, however, we must leave Mr. Grant's gun to stand on the recommendation of its inventor, which, high as we acknowledge his opinion to be, we regret that we cannot fully indorse.

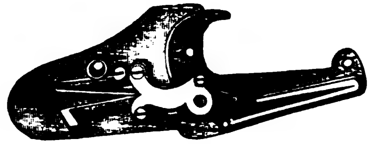
### Mr. Greener's Patent Side-lock Hammerless Gun.

In the year 1879 Mr. Greener forwarded the following description of a cheap hammerless gun to the *Field,* in which it was inserted on the 27th of December, 1879.

Sir,—Many sportsmen still have a preference for the old style of gun-lock, on account of its having been so well tried. Mr. Murcott seems to have been the first maker who made a successful gun upon this principle. The principal objection raised to his gun was that it required so much pressure to open the guns and cock the locks. This was owing to the lever employed to withdraw the action bolt and cock the locks being placed so far in advance of the tumbler pivots.

By re-modelling this gun and bringing the centres of the tumblers forward till they coincide with the fulcrum of the lever,

and by altering and re-arranging the lock mechanism, I have been able to produce a gun much neater in appearance, and which will open with a pressure of 10lb. upon the lever. It will be seen by



INTERIOR OF LOCK.

the accompanying engraving that the point of the tumbler has been made to explode the caps without any intervening exploding

MR. GREENER'S PATENT SIDE-LOCK HAMMERLESS GUN (half size).

pins. There is no increase in the number of limbs of the breech action. The lever, being extended above the action, comes into contact with a projection upon each tumbler, and, upon the lever being depressed to open the gun, the tumblers are raised into full-cock. The scears, tumblers, and scearsprings of the lock are much stronger than those of an ordinary lock, and there are eight less pieces in this gun than in an ordinary gun with hammers. This, however, does not include the safety, which may be either our ordinary side safety or an automatic, or an independent safety upon top of action. This gun opens so easily that it may advantageously be constructed with a short side lever fixed on either right or left hand lock, or an ordinary top lever.

I do not bring this gun forward as a better gun than the Anson and Deeley, but consider it the next best in simplicity, safety, and durability, and can confidently recommend it as being superior in many essential points to hammerless guns manufactured with a spiral spring in the locks, or with the lock mechanism arranged on the trigger plate. A really serviceable, well-finished gun on this principle, with good shooting, can be sold from 18*l*. 18*s*.

W. W. GREENER.

Having bar locks, no top connection, and no safety bolt, I must, in conformity with my opinion expressed elsewhere, refuse to commend the above.

TOLLEY'S NEW TOP-LEVER SNAP-ACTION HAMMERLESS GUN.

The following particulars of the new gun made by Messrs. J. and W. Tolley, of Birmingham, and to which they have


FIG. 1.—MESSRS. TOLLEY'S HAMMERLESS GUN (two-thirds size).

given the name of "The Perfection," have been supplied to me by the makers, who say: "It will be found to contain all the essentials of a really first-rate hammerless gun, viz.: 1st, opening with the lever, and *not* with the barrels; 2nd, safety bolt in front of hammers working automatically or independently, as may be desired, and the triggers locked simultaneously; 3rd, ordinary gun-locks free from all complication;

4th, top lever action and extended rib; 5th, easy manipulation; 6th, greatly improved appearance, contrasting most favourably in this respect with many of the guns now in vogue."

Fig. 1 shows the general appearance of the gun, and the tumblers B locked, which is their ordinary state until the second finger presses and releases the safety bolt E, Fig. 4.

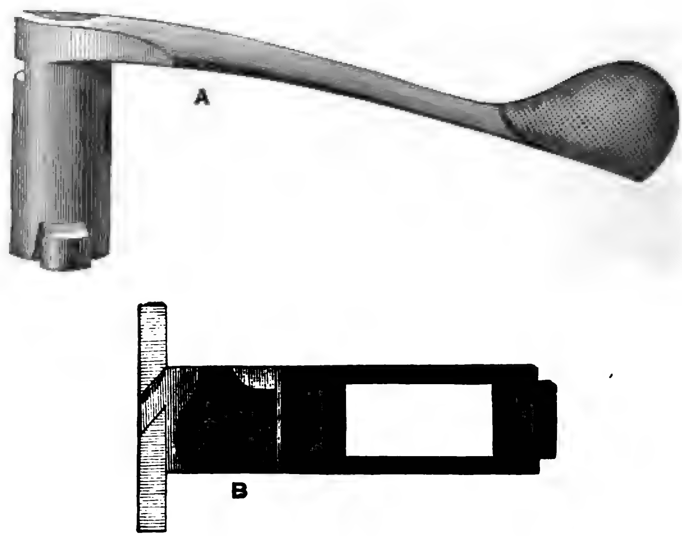



FIG. 2.—ACTION BOLTS (full size).

Fig. 2 A shows the thumb lever which withdraws the Purdey bolt.

Fig. 2 B shows the bolt with lateral projections at the base resting on the breast of the hammers, and which force the tumblers to full cock, as the bolt is withdrawn in opening the gun; and, at the same time, the safety bolt, Fig. 4, D (which has a diagonal stud on its surface, fitting a corresponding slot in the base of the bolt, Fig. 2, B) is forced into position automatically.

Thus by the one act of opening the gun the breeches are

exposed to receive the cartridges, the locks are placed at full cock, and the safety interposing bolt (Fig. 4, E D) is put in position for "safety" as there shewn, to act *between the hammer heads and the strikers.*

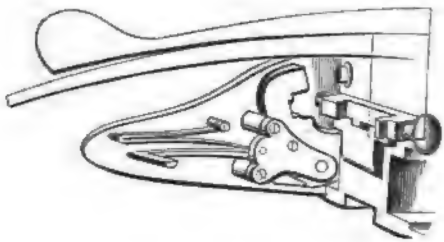


FIG. 3.—ORIGINAL INTERPOSING SAFETY BAR, IN POSITION (half size).

The gun can now be loaded and closed for firing; but, before the cartridge can be fired, it is necessary to remove the safety-bolt; which is done by pressing the button E home on to the left lock-plate when the gun may be fired.

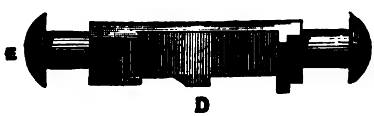



FIG. 4.—BACK VIEW OF INTERPOSING BAR.

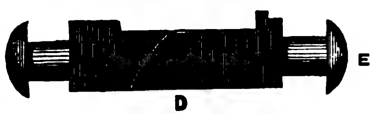



FIG. 5.—VIEW OF INTERPOSING BAR FROM BELOW.

(Both of full size.)

If, by any chance, the hammers were to be released from full cock, and were to fall down on the safety-bolt, no accident can occur, as the safety-bolt can only be removed when the locks are at full cock.

The locks are the ordinary gun locks, but with inside hammers.

A great improvement on this interposing bar, according to my judgment, has very recently been brought to my notice by the Messrs. J. and W. Tolley, which I think will meet any objections that may be made to the above mode of freeing the locks for firing adopted in their original plan.

Instead of the finger simply pressing one or other of the protruding ends, a double safety is arranged (see Fig. 5), comprising the original bar (D, Figs. 4 and 5) interposing

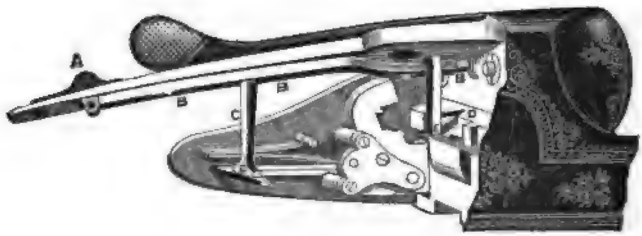



FIG. 5.—MESSRS. TOLLEY'S INTERPOSING SAFETY BOLT.

between the falling tumblers and the strikers, and also a leg (Fig. 5 C C) fitting over the scears and blocking them as well as the triggers. These bolts are both automatically put at "safety" in opening the gun according to the "original" plan, as explained at page 223. In adjusting this safety bolt the inventors have provided that, before the barrels are sufficiently opened to receive the cartridges, the interposing bar shall be in position at "safety," and the scears blocked by the leg attached to the controlling rod. This rod is moved to the firing position by the usual thumb piece on the strap of the action in Fig. 5.

A is the thumb piece actuating the double safety; B, the controlling rod; C, the leg blocking the scears and triggers; D is a wedge-shaped recess in the safety bar; E, a wedge-shaped foot to the controlling rod, acting on the corresponding inclination in the recess D, and freeing the locks for firing, by removing the interposing bar from the safety position, simultaneously with the releasing of the scears and triggers.

The safety bar travels in a dovetail in the body of the action, and is quite inclosed by the lock plates. It differs from other safety bolts in being moved by an inclined slot in the action bolt instead of being made to turn on a centre.

MR. ROGERS' BARREL-COCKING SIDE-LOCK HAMMERLESS GUN.

On the 21st January, 1881, Mr. Rogers, who is a lock filer, at Birmingham, patented an action by which a side-lock is cocked through the agency of a lifter acted on *directly by the barrels*. In these two respects only does it differ from the specification of the Anson and Deeley patent, which claims "the cocking of the gun by means of a fore-end lever," whereas in the specification of Mr. Rogers the claim is for a cocking lever, one end of which is depressed by the barrel itself—raising the tumbler of a side-lock; and not a lock the tumblers of which are sunk in slots cut in the body of the action. With the law of the case as regards the validity of Mr. Rogers'

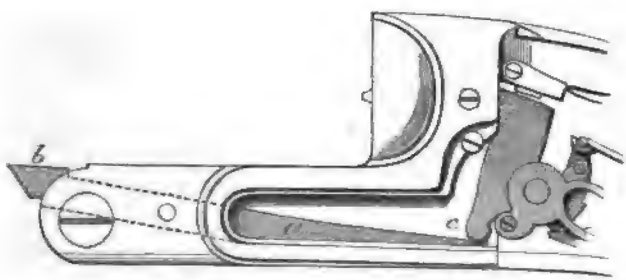



FIG. 1.—MR. ROGERS' ACTION, SHOWING COCKING LIFTER BEARING ON TUMBLER OF SIDE-LOCK, WHICH IS DOWN ON STRIKER.

patent I have no concern, and merely indicate the points of difference between the two.

On comparing Mr. Rogers' plan with that of the Anson and Deeley, described at page 183 *et seq.*, it will be at once seen that these asserted differences really exist.

Fig. 1 shows the body of the action cut away in the usual form to receive the bar of a side-lock, but the slot usually made to receive the mainspring of the lock is here occupied by the long arm of the cocking lever *a*, which impinges on a projection forward from the tumbler *c*, and raises it to full-

cock when the barrels fall on opening the gun, as shown in Fig. 2. In principle there is thus far a close resemblance to that of the Anson and Deeley cocking lever, but the actual force operating on the lifter by means of the short lever (Fig. 1 *a*) is exerted directly by the lower side of the barrel, which is in close contact with it, and not as in the Anson and Deeley by the sockets cut in the fore-end in which the ends of the lifters (page 184, *d*) are accurately fitted. So much for the action itself. As to the form of the side-lock, I shall presently describe it; but before doing so I may mention that the gun

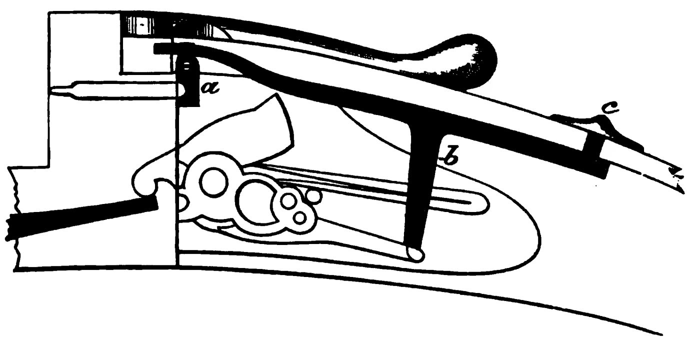
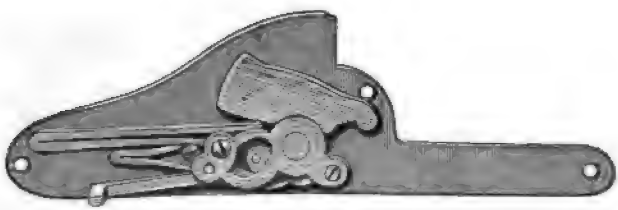



FIG. 2.—TUMBLER RAISED TO FULL-COCK, SHOWING ALSO JONES AND PENN'S SAFETY BOLTS.

as devised by Mr. Rogers is now made by Messrs. Claybrough Brothers, Whittall-street, Birmingham, who have purchased the patent from him. It has back-actioned side-locks on the rebounding principle, the object of which is to assist the cocking, which in consequence of the length of the long arm of the lifter would be otherwise rather hard. Indeed, even with its aid, and the use of weak mainsprings, the long-bodied action used by Messrs. Claybrough necessitates a lever, the force required to raise which for cocking is somewhat more than in the Anson and Deeley; but this is not of necessity involved in the plan, for, if the hinge-joint is placed as in the Anson and Deeley 1¾in. from the break-off, instead

of 2¼in., as in Messrs. Claybrough's gun, the lifting would be just as easy; but the above-mentioned firm, intending their gun chiefly for the American market, where very heavy charges are used, consider that by diminishing the distance between these two points the strength of the action would be reduced too much for safety. But, seeing that they adopt a Purdey bolt, as well as a top connection, with a strong toothed lever working in it, I certainly think they might with advantage imitate the Anson and Deeley proportions, to the great improvement of the facility in manipulating the gun.

As to the lock of the gun sent for my report, it is not that hitherto used by Messrs. Claybrough, but a new one recently devised, which appears to be admirably suited to this gun



BACK-ACTIONED LOCK, WITH SHAM BAR.

as well as to the Bentley pattern of the Gibbs and Pitt action, described at page 230. The lock is back-actioned, with a sham-bar, which closes the slot cut in the body of the Rogers' action without interfering with the lifter. This lock differs from that of Messrs. Scott's gun (page 196) in having a swivel acting by suspension on a projection backwards from the bottom of the tumbler, instead of *pushing* up the top of the tumbler, as in the Scott's lock. In this respect it resembles Messrs. Bland's improvement on the lock of the "Field" gun, as shown at page 191; indeed, in all respects, except the addition of the sham-bar, it closely follows the principle of that lock. This bar is, however, I think, a great improvement, wherever it can be applied

(especially in the Gibbs and Pitt), inasmuch as it replaces with advantage the metal of the action cut away to receive it, at once binding the stock to the action, and backing up the break-off. The throw of the tumbler is, however, greatly increased as compared with Bland's lock, being about equal to that of the Gibbs and Pitt lock.

Lastly, the safety-bolt in the Claybrough pattern is not up to my requirements, though it may serve the purposes of sport in the United States, where "loaders" are not yet in vogue. In the combination gun sent to me, their safety is replaced by Messrs. Jones and Penn's safety bolt (Fig. 2, *a*, *b*, *c*), which will be found fully described at page 250, but which I also insert here in order to render the action of the lifter on the tumbler perfectly intelligible (see Fig. 2).

The Messrs. Claybrough claim as the advantages of their gun when compared with the Anson and Deeley: 1st, that it can be produced at less cost, viz., at from 12 guineas to 15 guineas, according to quality; and, secondly, that a side-lock is used instead of one which cannot be readily removed for cleaning by the sportsman himself. On these points I shall leave my readers to judge for themselves.

But it appears to me that, by those who think a side-lock to be a *sine quâ non* (and no doubt there are many sportsmen of that opinion), and also require a barrel cocker, a gun constructed on this principle will, *primâ facie*, be considered a combination entirely to their satisfaction, and therefore independently of price, I shall venture to give an opinion on it. That opinion is, that to prove successful the cocking must be rendered easy by shortening the body to the extent mentioned above, and that an efficient safety bolt be added, such as that of Messrs. Jones and Penn, or the well-known one of Messrs. Scott and Sons. If this combination is well carried out, I think the designer will have no cause to complain of a want of support from the British public.

MESSRS. WEBLEY'S TOP SCREW-GRIP COMBINATION ACTION.

This new action has, in common with several others, been brought to my notice after the chapter in which it ought to be included had gone to press. I am therefore compelled either to omit them altogether or to insert them between pages 224 and 225, with the addition of letters to distinguish them, and as all those I shall presently describe present features of great interest to the sportsman, I have adopted the latter course.

The peculiarity of the bolts now under notice is that they combine the old grip draw with the Purdey snap-bolt. The latter is nearly of the ordinary form, and is actuated in the usual way by a cam at the bottom of the spindle, which is raised from below into the centre of the lever head, the two being held together by a screw, which keeps both to their

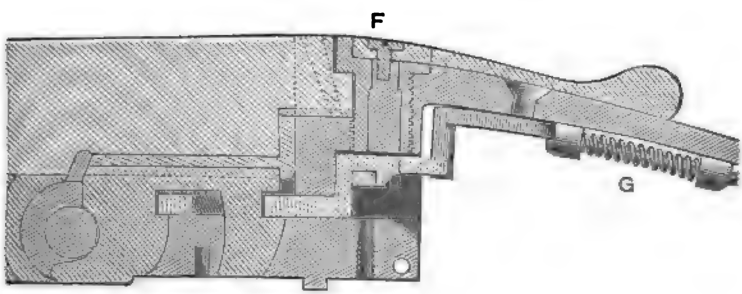



FIG. 1.—SECTION OF WEBLEY'S TOP SCREW GRIP COMBINATION BOLTS.

bearings. The several parts are shown in the above section in combination, as applied to the Anson and Deeley locks, but it may be combined very nearly as well with the Gibbs and Pitt top-lever action and side-lock, or with any other top-lever action, with or without hammers. The novelty consists in cutting a fine square-threaded screw on the perpendicular head (Fig. 2, A) of the top lever, which is made of tempered steel, and enlarged for that purpose. This screw-head contains within it, as above described, the spindle (B) working

the cam (Fig. 2, B). The screw-head fits into a female screw cut in the top of the break-off behind the doll's head, so that

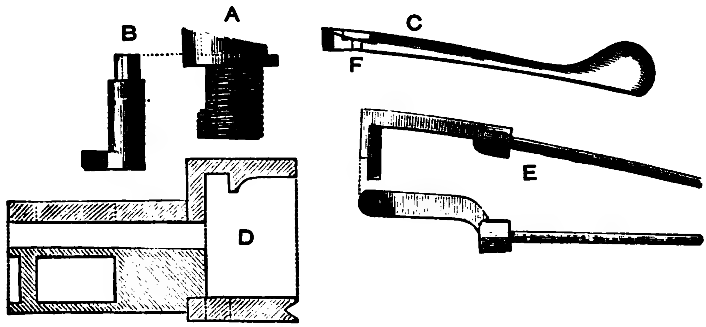



FIG. 2.—DETAILS OF WEBLEY'S COMBINATION SCREW LEVER.

the upper flange of the male screw, and the under one of the female only are in close contact, by which means all danger of "setting" is avoided. The spindle works the cam B, which latter actuates the under bolt D in the usual manner. The entire combination is worked by the top lever C, fitting securely into the square recessed head of the screw-grip, all being firmly bound together by a screw pin (Fig. 1, F). The spring (Fig. 1, G) actuating both the Purdey bolt and the screw grip is a spiral one, applied to the end of the bolt D, Fig. 2, by means of the spring bar E. The extended rib of the barrel is held down by the head of the screw grip engaging with it on closing the gun.

A beautifully designed pigeon gun with these bolts was brought to my notice by Mr. Leeson, of Ashford, the workmanship of which was of a very high quality; and I cannot but think the combination an admirable one, and particularly well adapted for guns used with heavy charges, while at the same time its manipulation was extremely smooth and easy. The plan is the invention of Mr. Thos. W. Webley and of Mr. Brain, one of the *employés* of the firm. It may be made with or without a doll's head, and really resembles the old grip

action, with the advantage that the grip is at that part of the barrel (its extreme rear end), when it tells to the greatest advantage, and is, further, superior to the old grip, insomuch that there is no undue friction, the bearing parts not coming into contact until the barrels and screw are dead home; and they as instantly part contact as soon as the lever is touched to open the gun. This is caused by the pitch of the thread on the screw, and to this advantage may be added that it is self-locking.

### Webley's Side-Lock Hammerless Gun.

While exhibiting the last described gun, Mr. Leeson also showed me a modification of his "Invicta" gun, recently patented by the same firm of P. Webley and Son. It combines the side or under lever variety of the Gibbs and Pitt action with one of the No. 7 form of the Webley system of treble bolts, and their new patent tumbler blocking safety-bolt.

Fig. 1.—Webley's Side-Lock Hammerless Gun.

This gun is cocked by the Purdey bolt of the Gibbs and Pitt plan in the same manner as several hammerless top-lever guns now before the public, such as Mr. Leeson's "Invicta" and others; but the connection of a top bolt with the Purdey bolt without a top lever is a novelty, and

the carrying out of the plan was more than usually difficult from the fact that the under and top bolts are

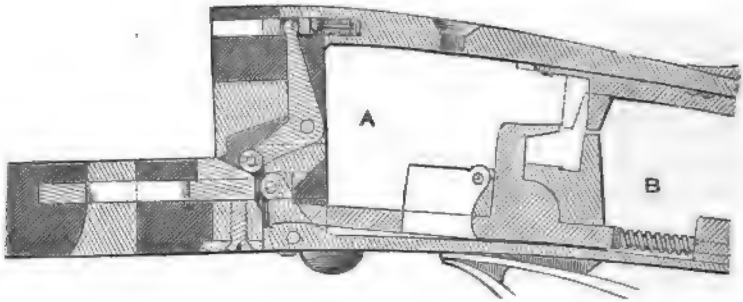



FIG. 2.—SECTION OF WEBLEY'S SIDE-LOCK HAMMERLESS GUN (two-thirds size).

required to travel together only a sufficient distance to release the barrels. The under bolt then, while the barrels are falling, and assisted by the fall, continues its travel to cock the tumblers, the top bolt remaining stationary. This difficulty has been overcome by the introduction of the bell crank lever (Fig. 2 A), shown in section. The short end of this lever is raised by the action of an inclined plane on the Purdey bolt, which ceases to travel so soon as it reaches the top of the incline. When the gun is closed the spring (B) on the trigger

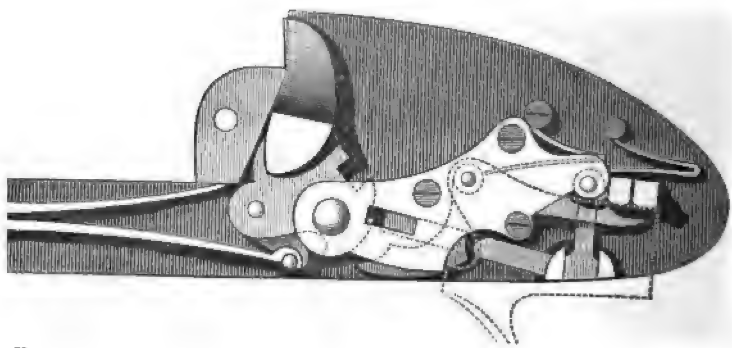


FIG. 3.—WEBLEY'S HAMMERLESS LOCK DOWN ON STRIKER, WITH THEIR SAFETY AUTOMATIC TUMBLER BOLT (full size).

plate drives the lever and under bolt home, leaving the top bolt to be driven home by the small independent spiral spring

behind it. And if the bolt is only freed to about, say, half way home in the first instance, it will act as a compensating bolt.

This gun is fitted with a new lock and safety blocking tumbler bolt, which is shown as in Fig. 3, after the trigger has been legitimately pulled. This, acting upon both scears, has withdrawn the safety bolt from a slot in the tumbler and the scear nose from the bent. The tumbler has consequently fallen on the striker. In Fig. 4 it is

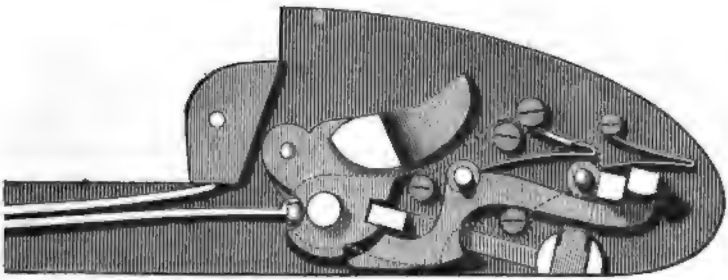


FIG. 4.—THE SAME LOCK, BLOCKED—THE BRIDLE REMOVED (full size).

supposed that the tumbler has been only withdrawn, to represent a jar out of bent from any accidental cause, when (the trigger not having been pulled) the bolt is in its slot, and prevents the tumbler from falling on the striker. In addition, there is also the usual trigger bolt and slide, as shown in Fig. 2.

Besides the above novelties, I shall also describe the following variations of, and improvements on, the original Westley Richards top connection and bolt, beginning with the most simple form, viz.,

## WEBLEY'S SIMPLE TOP BOLT (No. 6).

This plan, which is No. 6 in the system of the firm, is very similar to that used in the original Westley-Richards gun, the difference being that the bolt is put in from the front, which allows it to be made much stronger, and prevents the

necessity of cutting out the strap by which water is admitted under the lever; it also takes its bearing on the barrel exten-

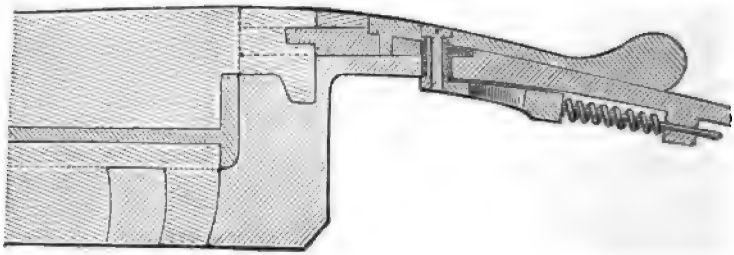


FIG. 1.—WEBLEY'S NO. 6 PLAN OF TOP BOLT.

sion in the centre of its entire length, instead of at the extreme end; and it is alleged that the objection to the oblique bearing of the W. R. bolt is thus entirely overcome—that of the bolt being at right angles to the face of standing breech.

The rod on which the spring works is connected with the lever (passing up at the rear of both), instead of with the bolt itself, as in the Westley-Richards action, thus always keeping the lever firmly home, and correcting that looseness often felt in the Westley-Richards lever.

### WEBLEY'S COMBINATION BOLT (No. 6).

This treble bolt is also put in from the front, in the same way as that last described, but it is connected with the Purdey

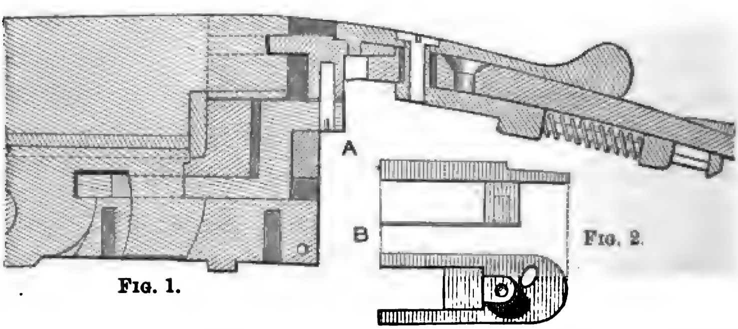
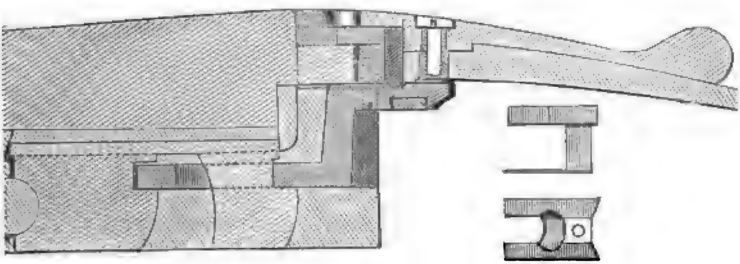



FIG. 1.—WEBLEY'S COMBINATION BOLT (No. 6). FIG. 2.—PLAN AND SECTION OF TOP BOLT.

bolt at A by a screw which passes up through both. Messrs. Webley therefore claim not only the putting the top bolt in from the front, but the addition of the foot on the under side, which comes down to the top of the under bolt, and enables them to pin the two bolts firmly together. The piece of thin steel B between the two bolts effectually closes the open space that would otherwise exist when the under bolt is drawn back.

WEBLEY'S COMBINATION BOLT (No. 5).

In this action the top bolt is put in from the front like the No. 6 treble bolt system, but the lever actuates "with its



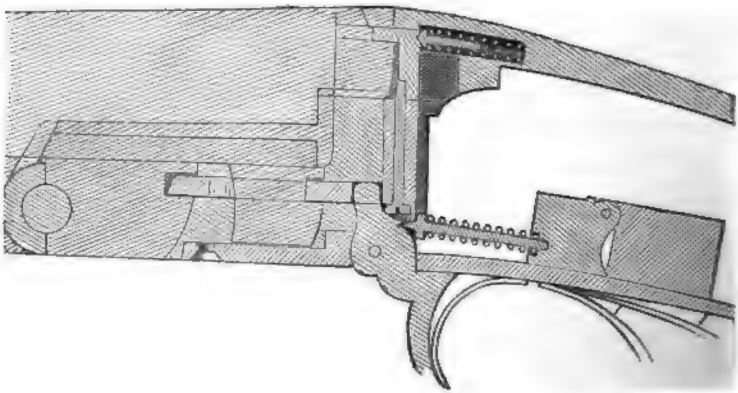
SECTIONS AND PLAN OF WEBLEY'S COMBINATION BOLT, NO. 5.

intervening tumbler" the under bolt, which in its turn carries the top bolt, instead of the top bolt carrying the under bolt, as in No. 6.

WEBLEY'S COMBINATION TREBLE BOLT ACTION, NO. 2.

This is an extremely simple and yet strong treble bolt-action, and is worked by an under or side lever. The under bolt is withdrawn by the lever in the ordinary manner, and is driven by a spiral in a very simple and efficient way. The top bolt is withdrawn by the inclined plane on the pin that passes through the upright tail-piece of the under bolt, which is carried up to the top bolt, as in the Webley system, No. 5 and No. 6. On closing the gun the lever and under bolt are driven home, the latter by the spring over the trigger plate, and the former by the action of the spring at its rear end, which will drive it home, or only part of its full travel, according as

the gun is freed. If only freed in the first instance, to go, say, half its full distance, it will act as a compensating bolt, and gradually wear its way home.



SECTION OF WEBLEY'S COMBINATION TREBLE BOLT ACTION, No. 2.

The actions recently described as made by Messrs. P. Webley and Son are not, of course, in all cases made at their works, but frequently under a royalty paid to them, as, for instance, in the case of Mr. Leeson, of Ashford, who, as before remarked, exhibited to me the pigeon gun, with screw-top grip, and the improved "Invicta" gun. The various top and combination bolts, which display great ingenuity, are also in some instances made in a similar way by London and country makers. In Mr. Leeson's guns the barrels were made of Siemens's steel, which will be found described in the Appendix, and are also choked on Messrs. Webley's plan, which is there likewise mentioned. I certainly was not aware that any other steel than Whitworth's is now used for gun barrels, and have so stated at page 90. I find, however, that for some years Messrs. Webley, finding great difficulty in getting Damascus and laminated barrels without greys, have used a mild steel made by Messrs. Siemens, and, as they think, with great advantage. This matter, however, will be found fully described in the Appendix.

## Messrs. Powell and Son's Action and Safety Bolt, with Anson and Deeley Lock.

The following is the report on this action published in the *Field* of March 25, 1882 :

The safety bolt recommended to be used with the Anson and Deeley hammerless gun has until recently been one bolting the triggers only; the inventors, backed by Mr. Greener's authority, considering that the scear is so strong, as to be free from all

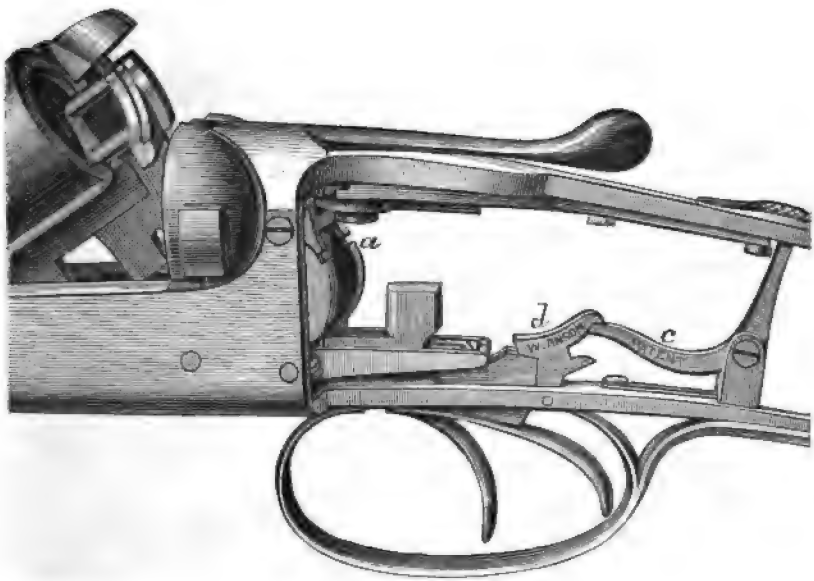



Fig. 1.—Messrs. Powell's Cross Bolt Action and Safety Bolt with Anson and Deeley Locks.

liability to accidental discharge from a jar or fall of the gun. Our readers are aware that we have for the last three years warned them against depending on this reliance; and it is manifest that if an automatic bolt is to be used (which all gunmakers now admit), it should be made as secure as is possible, so long as there are no drawbacks to the plan adopted. We have lately described two plans which we consider perfectly safe, and also free from any drawback; and we are now pleased to add to the list another, which has been brought to our notice by Messrs.

Powell and Son, of Birmingham, as applied to the Anson and Deeley action, with their patent cross bolt (described at page 163).

The improvement consists in adding to the Anson trigger bolt an intercepting bolt, worked by the same slide, both being brought into action by the top lever before the gun can be opened. The intercepting bolt is fitted across the back of the break-off; its centre being close to and above the segment of the circle described by the striker, and having a projection downwards, which acts on a bent in the striker, just as a scear does on that of the tumbler. When at full-cock this projecting bolt lies freely in the bent, and is easily moved to "safety," automatically as well as optionally,

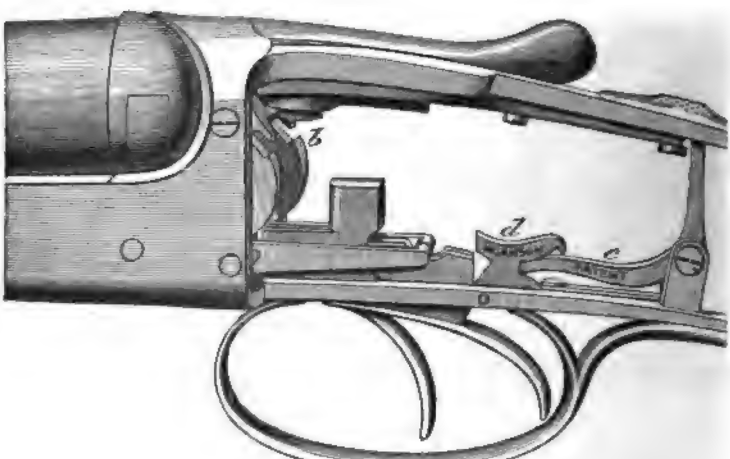



FIG. 2.—MESSRS. POWELL'S ACTION WITH SAFETY BOLT AT "FIRING."

while it is set at "firing" by the usual slide. If, however, the scear is jarred out of the bent while set at "safety," the bolt drops into its bent, which is cut like the half-cock bent of the hammered gun, and, after intercepting the blow, cannot, from its shape, be pulled off by pushing the slide forwards, which is an accident most necessary to guard against. Fig. 1 *a* shows this bolt at "safety," and Fig. 2 *b* the same when set for firing. The usual Anson bolt i shown at *d c* in each Figure.

We have great pleasure in giving our opinion that this arrangement is very simple and effective, and that it is so strong as to be unlikely to get out of order. In fact, unless the accident to which we have alluded has taken place, the work of the bolt is almost

*nil*; and as the chances are considerable against such an accident, the "wear and tear" of the bolt is not an important element in the calculation.

### Messrs. Purdey and Sons' Gun.

I must now allude to the gun which has lately been offered to the public by the above celebrated firm, as the only hammerless gun which can be recommended to their customers. This most ingenious invention was described by me in a report on the Sportsman's Exhibition held at Islington in February, 1882. I had carefully examined it previously when

Messrs. Purdey and Sons' Hammerless Gun.

brought to me by a customer of the firm and, finding it in the exhibition, but without the presence of an attendant, when I happened to be there, I very naturally thought it was intended to be noticed, and accordingly recorded my opinion of it in my report. Soon afterwards, however, I received a note from Mr. Purdey in reply to a question relating to another subject, stating that my notice of it was "against his wish," and that it "was singularly incorrect in one respect," though he further wrote, "inadvertently so, I have no doubt, as the guns

shown were never taken to pieces." Now as Mr. Purdey himself had shown me this gun only a few days before, taken to pieces, and placed in my hands with his own full explanation, I am at a loss to know how the latter remark applies, but in any case I shall content myself with giving an engraving of its exterior, and repeating the report which I then gave, and which, having been published, cannot, of course, be considered unmade, or I would so consider it. Mr. Purdey did not, moreover, inform me in what particular I had been "singularly incorrect," and I am therefore unable to make the correction if such is necessary. The notice must be taken for what it is worth, but I may state that I have since that time again examined the action, and am unable to detect the error complained of. The following is the notice alluded to:—

The Purdey invention is a hammerless gun possessing the neat exterior for which the firm is celebrated, and also great facility in opening the action, which is effected by the lock mainspring bearing on a small lever which lifts the breech in such a way that as soon as the top lever is turned home the breeches rise of themselves, and a very slight increase of force by the hand allows the cartridge to be extracted and renewed. This is done by the upper limb of the mainspring, which is hung on the rebound principle, and as soon as the pressure is taken off in the manner above-mentioned, it being stronger than the lower limb, raises the tumbler to full-cock. No sooner, however, is the pressure put on again in closing the gun, than the lower limb exerts its force on the tumbler, and it is ready for firing. But there are disadvantages attending the arrangement which must be considered in estimating the *pros* and *cons*. *Imprimis*, there being of necessity a direct connection between the mainspring and the action, water is thereby liable to be admitted to the locks, though not to the same extent as in the Anson and Deeley, and some other actions; and secondly, in closing the action, extra pressure is put on it in order to compress the mainspring; and, this being done at the exact time when the scear is liable to be jarred out of the bent, we fear there is more than usual danger of such an event leading to the discharge of the gun

by the loader behind his master. We need not say that in guns so carefully made and regulated as those of Messrs. Purdey, such an accident is not likely to happen; but in sport, when it is possible to eliminate a danger, we think it ought to be done. In any case, with such a plan as the above, a perfectly safe automatic bolt ought, in our opinion, to be provided; and here we are disappointed, as the triggers only are bolted in the usual way with their shot guns, but in a more careful manner with their rifles, in which latter it is admitted the first discharge often jars the scear out of the bent, and causes both charges to explode together. While, therefore, we greatly admire the general design of this gun, we cannot fully recommend it until a plan for locking the tumblers has been added—by means of an intercepting bolt.

### Messrs. Gibbs and Pitt's Bar Lock Action.

Within the last three or four years, Messrs. Gibbs and Pitt have allowed an alteration to be made in their action and lock, described at page 180. As usually made and sold (which it now is in large numbers, being in the hands of several wholesale Birmingham makers), the safety bolt is in my opinion defective, and the action is dangerously weak, owing to the absence of all top connection, and the use of a bar lock cutting away the angle of the break-off, which, at page 150, I have shown to be liable to give way under the use of strong charges. Under these to me unsatisfactory conditions, this action is sold to many London and provincial gunmakers; but I am informed by Mr. Gibbs himself that he prefers the under guard lever and the back-actioned lock, and that he combines an automatic blocking bolt with the usual trigger bolt if so desired by his customers, though he considers the optional bolt sufficient. Messrs. Cogswell and Harrison, of London, have, however, combined it with Scotts' safety bolt, and have also added a top connection, making the gun safe in both respects, the only drawback being the necessity for care in pushing home the lever, without which it arrests the striker. The following is its description :—

### Messrs. Cogswell and Harrison's Desideratum Cheap Hammerless Gun.

In introducing this gun to the notice of the public, the above-mentioned firm state that "they are endeavouring to provide a long-felt want, viz., a good and simple hammerless gun, with a perfect safety arrangement, at a moderate price;" and, after a careful examination, I can indorse their statement without reserve.

As to the action, it is furnished with the well-known Purdey bolt, in addition to which there is a doll's head and small lever-tooth working in it, by which the weakness incidental to the cutting away of the break-off angle rendered


Fig. 1.—Messrs. Cogswell and Harrison's Desideratum Gun.

necessary by the bar-lock is provided against (see Fig. 2). The cocking is effected by a split prolongation of the Purdey bolt backwards, acting on a projection from the inside of the tumbler on the Gibbs and Pitt principle, and it is done with

the use of very little power applied to the top lever. Fig. 1 shows the gun opened for loading, and the cocked tumbler visible through the glass-filling the detector opening. Fig. 2 is a view of the right lock removed from the stock, with the tumbler cocked, and the safety block in its place ready to intercept the blow if given before the block is lowered by the pull of the trigger.

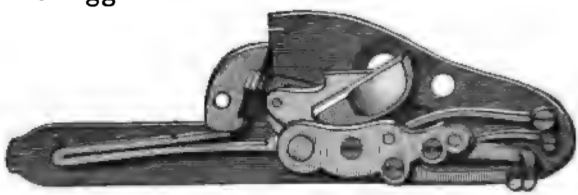


FIG. 2.—GIBBS AND PITT'S BAR LOCK (WITH SCOTT'S SAFETY BOLT).

Here, then, we have a hammerless gun with a sufficiently strong action, and with indicator bar-locks on the ordinary plan, but also provided with safety bolts fully meeting with the requirements which I have always laid down as essential to safety, and which I have fully described under Scott's patent at page 196. The gun is, in fact, a combination of plans patented by Gibbs and Pitt, Scott, and Purdey, and made under royalties granted by the two first-mentioned firms, but the patent for the Purdey bolt has expired. The gun, as will be seen from the engraving, has a very neat appearance, and is fitted with Messrs. Scott's indicators. Plainly made, with barrels of Damascus iron, it is sold by the above firm at 16 guineas.

CHARLES LANCASTER'S PATENT FOUR-BARRELLED HAMMERLESS GUN.

In the *Field* of Jan. 14th, 1882, I described this novelty as follows:—

This ingenious invention is constructed on the principle of the ordinary revolver, with this difference, that, instead of the chambers taking a turn before each discharge, a piston-like hammer rod is made to perform a similar office by the pull of the trigger, its head

being brought to bear in turn on the centres of the four barrels, which are brazed together in the usual way, so as to form a square, and are fitted to a break-off, which is necessarily of double the usual height. The action may be either "double grip" or "snap;" but, though the prong of the break-off is solid, the extra leverage brought to bear on it by the upper pair of barrels requires some top connection, and a "doll's head" is therefore used to give greater security.

To understand the construction of the lock it must be considered as having three offices to perform: First, the simple blow necessary for the explosion of the cap; secondly, the cocking process; and thirdly, the rotation of the hammer rod which it has to perform—the three being here placed in the reverse order to that which they go through in practice.

First. To effect the blow, a solid steel rod is firmly socketed horizontally—that is to say, parallel with the axis of the barrels, and opposite the central point between the four. Its fore end is turned in the solid to a right angle, like the handle of a walking stick, to a length enabling it to reach a little beyond the centres of the four barrels when it revolves in succession towards them, and is then capable of giving a blow to the selected striker, of which there are four fixed in the usual way in the break-off. On this rod is a collar, which receives the blow of a flat tumbler placed on one side of it, and furnished with a swivel and a flat mainspring hung on the rebounding principle.

Secondly. To cock this rod, there is behind the tumbler another collar, by which it is enabled to bring back the hammer rod to full cock from the half-cock, where it was left by the rebound. There is only one trigger, which is either of the usual form or like a ring, as shown in the engraving (Fig. 1.) To this is hinged a lifting scear, which fits into a deep bent or notch, cut in the tumbler in such a form that as the trigger is pulled it lifts the tumbler backwards over its centre or axle, and at the same time compresses the mainspring.

Thirdly. There is a quarter revolution of the hammer rod to be effected, so as to bring its head in turn on each of the four barrels. This is done by cutting four inclined grooves or slots on the rod, as well as a corresponding number of straight slots in front of the tumbler and opening into one another. Into these slots there is fitted, on a spring plate, a stud, so placed that the hammer rod, being drawn back by the tumbler, is made to rotate

FIG

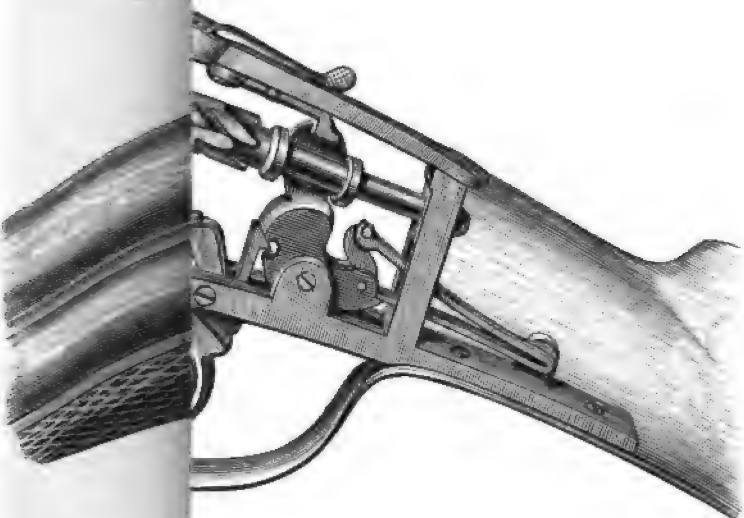
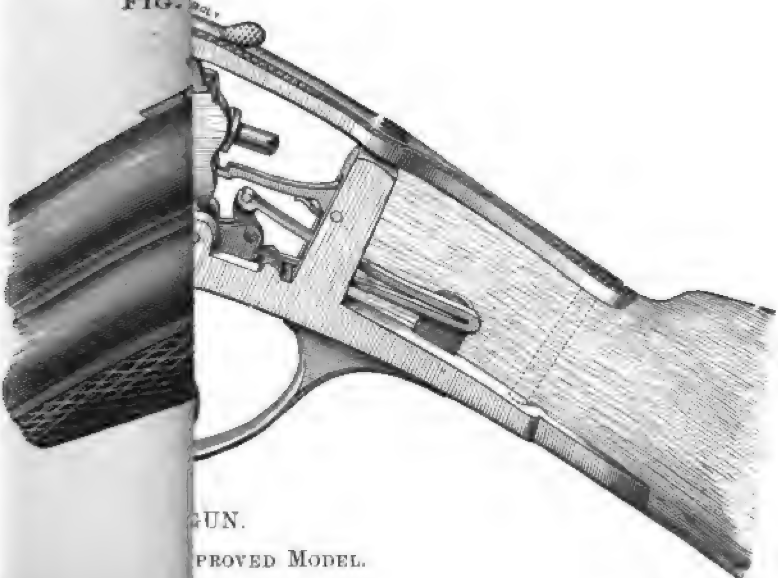


FIG.



GUN.

PROVED MODEL.

one-quarter of a circle by the inclined grooves; and, this being done after each barrel is fired, the four are discharged in succession by as many pulls of the trigger. These slots are cut of different depths, the spring of the stud dropping from one to the other at the desired points, so as to effect the revolution when in the inclined slot, and yet permit the hammer bolt to pass straight forward in striking the blow, and return to the slanting slot for the next quarter turn. By a combination of these three movements, as the trigger is pulled; it, by the aid of its lifting scear, raises the tumbler—and with it the hammer rod—to full cock. While doing this, the stud in the spring plate above mentioned has caused the rod to revolve a quarter turn, and has consequently brought its head from the centre of the barrel last fired to that next in succession. The scear then leaves the bent free, when the tumbler drives the hammer rod forward to explode the cap. Immediately after this, a long straight spring under the front of the trigger carries the scear into the bent of the tumbler, ready for the next shot, in which it is assisted by a light spring between the scear and trigger.

It is difficult to imagine anything more simple than the above piece of mechanism, though it requires the elaborate description we have given to make it intelligible. There may be, and probably will be, many good sportsmen who will object to the use of a weapon which will be by them characterized as murderous—and on this point we shall certainly offer no opinion; but, granting the desirability of a four-barrelled gun, we cannot refuse to record our admiration of the invention by which the design has been carried out. Of course, the prolonged draw of the trigger, necessitated by the cocking process, will at first interfere with the aim, and this must in any case be set down as more or less objectionable.

Having thus described the mechanism of the new gun, we must now proceed to discuss its merits, from the same points of view as those which we last week propounded in reference to Mr. Rigby's gun.

1. In regard to safety. As the cock is rebounding, the scear cannot be jarred out of its bent in loading, and the danger of an accidental discharge is confined to a pull of the trigger, either unintentionally by the shooter, or by means of a twig in a hedge or elsewhere. As this pull is longer than in an ordinary gun, being what is technically called a "draw," this danger is certainly reduced to a *minimum*; but it exists nevertheless, and is

provided for by a safety bolt, which is fixed in the tang of the break-off, and when used pushes a bolt into the tumbler, by which this part is securely locked. There being no outside hammer, the rebounding lock is secure from the accident which sometimes occurs in hammered guns, in which a twig or other projection raises the hammer nearly to full cock, and then drops it on to the striker. It may, therefore, be said that from all danger of a discharge in loading this gun is free; and that the safety bolt, if used in getting through a hedge, effectually prevents the pulling of the trigger by a twig. In opening the gun the lock is left quite undisturbed and at half cock, neither the fall of the barrels nor the lever acting upon it, as in most hammerless guns.

2. In its manipulation there is only the difficulty connected with the cocking by means of the trigger, in regard to which practice alone can determine the amount. Manifestly it will increase the uncertainty as to the aim in a crossing shot; but how much this will operate must be left to the same method of decision.

3. The exclusion of water and gas from the lock is well provided for, especially with the double-grip action, as the striker holes are alone capable of admitting either. These all open backwards into a circular chamber cut in the wood for the revolution of the hammer head, the only communication with the lock being by means of the rod, which, revolving in its well-fitting metal socket, can hardly be practically considered as any opening at all.

4. The "wear and tear" will probably be found greater than usual, as the hammer-rod has more than ordinary work to sustain; but here again practice alone can be relied on, and we hesitate in giving any opinion.

5. The stock is unusually strong, being cut away very little for the single lock; and, having a head of double the usual depth, it is capable of being chambered for the hammer-head, so as to leave plenty of wood. It is also dropped into two side slots in the break-off, by which any side twist is prevented.

In appearance the gun differs from the double-barrel only in presenting four barrels instead of two, and in its consequently greater depth of head, the hand being of the usual size. It is built either of 12, 16, or 20-bore; the last, weighing 7lb. 5oz., and regulated to 3drs. of powder and an ounce of shot, is the size recommended by the inventor for ordinary shooting; the 16-bore for battues or driving, and the 12-bore for wildfowl, especially

flight shooting. He also builds rifles on this principle of ·400, ·450, ·550, and ·577 bore; and it can also be applied to single or double barrelled guns and rifles.

### C. Lancaster's Improved Four-Barrelled Hammerless Gun Patent.

Shortly after this the following report appeared in the *Field,* together with an engraving of the improved mode.

The action now under consideration has so many advantages over the original one described in the *Field,* Jan. 14, 1882, that it is necessary to give the following description (see Fig. 2):

In order to cock this cylinder there is behind the tumbler another collar, by which it is enabled to bring back the hammer cylinder to full-cock from the half-cock, where it was left by the rebound. The main improvement, however, consists in a double trigger, the back portion of which is held by the second finger. To this is hinged a lifting scear which fits in to a deep bent or notch cut in the tumbler, and as this trigger is gripped it lifts the tumbler backwards over its centre or axle, and at the same time compresses the mainspring. The cylinder being thus held at the full-cock ready to be discharged, another front trigger, hung or hinged in the centre of the long lifting trigger, is so fitted that it works under the lifting scear, and finally removes it from the bent by the pull of the forefinger. The pull of this is exactly similar to that of an ordinary gun, and if not pulled the tumbler simply drops to the rebound half-cock on taking off the pressure made by the second finger. The revolution of the hammer cylinder is effected as in the original gun, so as to bring its projection in turn on each of the four barrels.

In opening the gun the lock is left quite undisturbed and at half-cock, neither the fall of the barrels nor the lever acting upon it, as in most hammerless guns, &c. The exclusion of water and gas from the lock is well provided for, especially with the double-grip action. The lock work is carried as follows: The revolving hammer cylinder is on the steel rod, which is firmly secured into the back of the breech action, and the remainder of the work on the trigger plate, which has one upright and is held to the breech in the under part, one screw passing through the tang or strap of the breech and an under breech pin passing through the stock and firmly holding the tang ends of the strap of breech and trigger

plate. It is consequently much stronger, and makes a sounder action, if possible, than the original gun.

The objection we mentioned in the description of the original gun on Jan. 14, 1882, viz., the extra draw necessitated by the cocking process, and which we suggested would interfere with the aim, is here removed; and therefore the gun or rifle is now as perfect in that respect as one with ordinary locks and triggers.

## SECTION III.

### Self-extracting or Ejector Guns.

Quickness in loading is so much insisted on by many battue shooters, that the slight gain afforded by automatic extraction of the empty cases is approved of by them, and several guns on this construction have been invented, the original one being brought out by Mr. Needham, gunmaker, of Birmingham. I confess that I cannot see the gain resulting from this arrangement, for if a loader is employed he has almost always plenty of time for extraction by the fingers, though no doubt occasionally pheasants in a "hot corner" do rise so fast as to task his nimbleness. On the other hand, if there is no loader the gun becomes too hot to hold, even if only fired as fast as it can be loaded by the sportsman himself, without a self-ejector. Nevertheless there is doubtless a demand for these guns, and I shall therefore proceed to describe them, beginning with Mr. Needham's, which is the foundation of the others used in England, and to whom royalty must be paid in all the plans hitherto devised.

### Needham's Self-extracting or Ejector Gun.

In this ingenious invention a projection from the hammer is made to bring out the extractor with a jerk in the following manner: The tumbler is of the usual construction, with a jointed striker, as in Murcott's gun, page 177. In addition

to this, however, there is a long projection from it forwards and sideways (Fig. 2, *a*), which when the hammer falls drops into a hollow at the top of the lump just beneath the level of the barrels. As the barrels are raised, and before the tumbler is cocked, this projecting arm is lifted out of the hollow above mentioned, and, sliding down an inclined

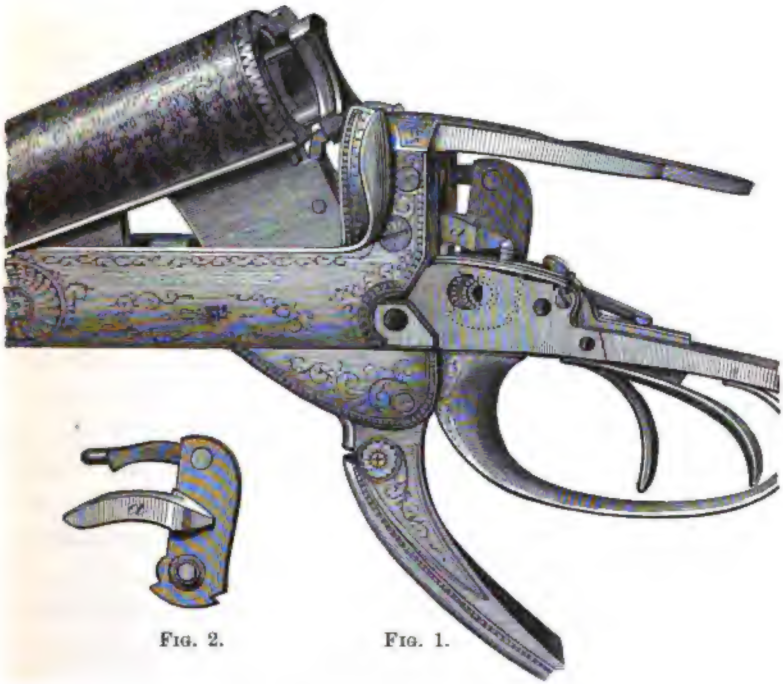


FIG. 2. FIG. 1.

**MR. NEEDHAM'S EJECTOR GUN.**

plane at the back of the lump (see Fig. 1), drops upon a lever attached to the extractor (which is made in two pieces, one for each barrel), and flips out the cartridge case with a jerk sufficient to throw it clear of the gun. If one barrel only is fired the other tumbler is still cocked, and only one case flies out, while if both are fired both cases are equally acted on by the same power, viz., that of the mainspring, but

still independently of each other. This gun, like that of Messrs. Gye and Moncrieff, page 201, necessitates a prolongation of the lump downwards, which is an eyesore, and the open space in which the tumbler arm works on the extractor is so great as to admit water to the locks most profusely. The lever also must be depressed with great force at the end of the stroke in order to effect the ejection. A scear without a spring is used by Mr. Needham, but it is not always adopted by those who make the gun under his royalty.

Mr. Charles Lancaster in 1879 made this gun with a top lever, and Mr. Greener has also modified the plan considerably under a royalty from Mr. Needham in the following way:

### Mr. Greener's Improvement on Needham's Patent.

This gun is much more sightly, and also less subject to the invasion into the lock of water. The main change in appearance is in the substitution of the top lever for the under guard lever, but the alteration in principle consists in the direct action of the unaltered tumbler on the ejector instead of an extra projection doing the work. To effect this Mr. Greener at first placed the mainspring behind the tumbler, as in Fig. 1, but he now introduces it in its usual position with the Anson and Deeley lock, as in Fig. 2. In either case the water is kept out of the lock much more completely than in Mr. Needham's plan, and the action is also stronger, while the ejection of the empty cases is quite as flippant and complete. The external appearance of the gun is also greatly improved, the awkward looking lump below the action being done away with, and the top lever substituted for the under guard lever without the objection sometimes attending on the former. Fig. 2 explains the action of the ejector, which works on the forward portion of the lump instead of behind,

as in Needham's gun. In the engraving (Fig. 2) the cocking projection from the tumbler is shown as having just slipped

FIG. 1.—MR. GREENER'S IMPROVED EJECTOR GUN.

off the swivel and engaged on the ejector lever, the upper end of which works on the rod of the extractor, and flips out the empty case.

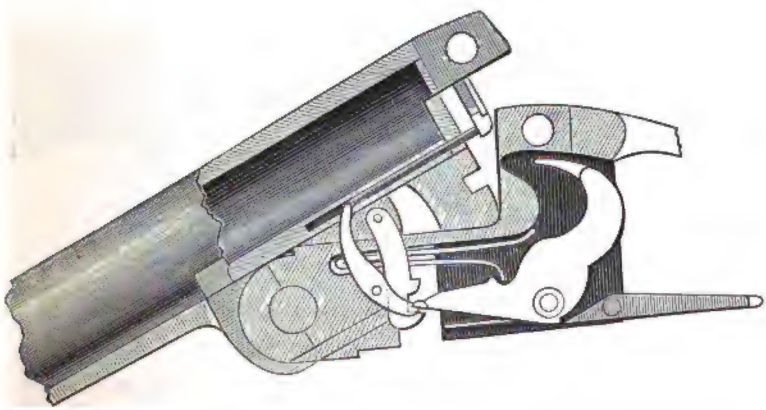


FIG. 2.—DIAGRAM OF THE ABOVE GUN, SHOWING THE ACTION OF EJECTOR.

## Mr. Charles Lancaster's Ejector Gun.

This gun is built on the same principle as that of Mr. Needham, but with a top lever and a less number of pieces than in his, and with the drop of the barrel cocking the gun. Unless the gun is opened sufficiently to cock the lock it cannot be closed, by which a great source of danger existing in many hammerless guns is avoided, viz., that if the tumblers are not properly cocked, in closing the barrels, the tumblers are allowed to fall on the strikers, and so cause an accidental discharge.

As to the mechanism of this gun, the barrels are made with doll's head top extension lump, and top lever. The safety is automatic in action, the piston spindle of the top lever forcing an arm backwards on to the scears and triggers upon the lever being moved to open the gun, but there is no blocking bolt.


Fig. 1.—Mr. Charles Lancaster's Ejector Gun.

At the breech end of the barrels there is an extra deep steel lump, lodged in the projection from the body (Fig. 1 B), which, as the barrels drop ready to receive the cartridges, rises and cocks the gun by engaging the tumbler.

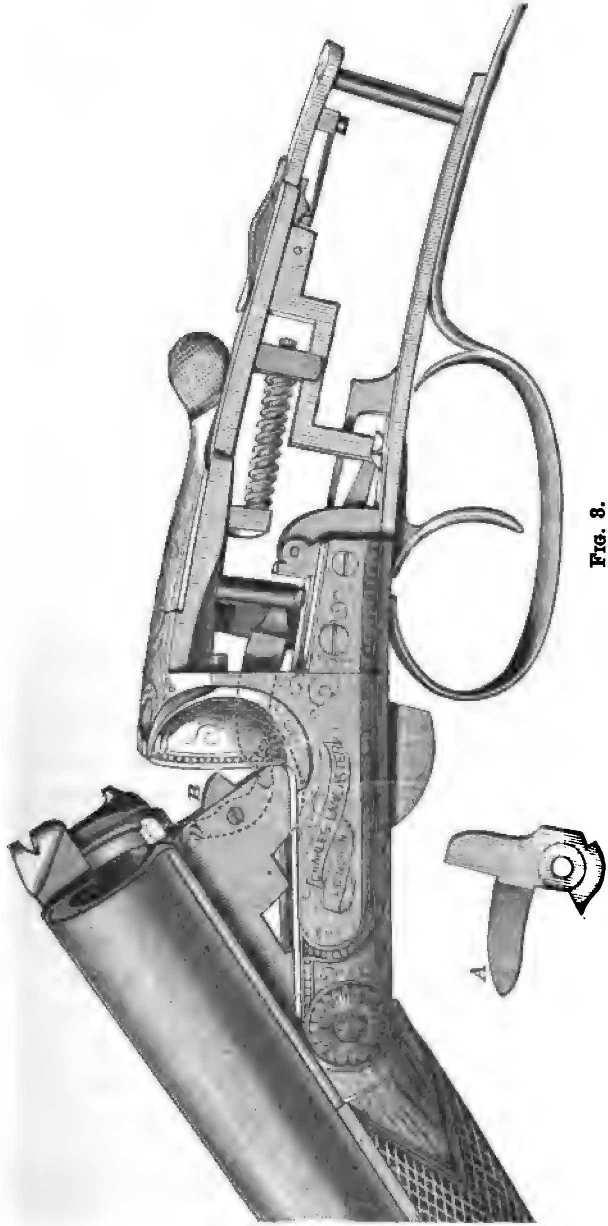



FIG. 2. FIG. 3.

MR. CHARLES LANCASTER'S EJECTOR GUN.

Fig. 4 shows this lump in outline with its extension shaded, and the ejector also in outline in its two different positions, its ends being also shaded where they project from the lump. The ejector is shown separately in Fig. 5.

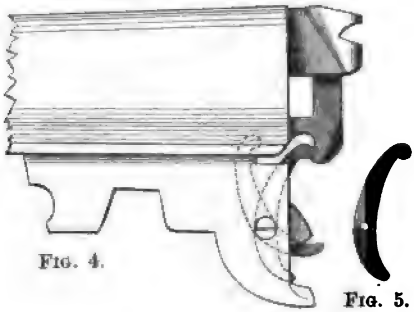


FIG. 4. FIG. 5.

ACTION OF THE EJECTOR IN MR. C. LANCASTER'S GUN.

When one barrel only is discharged and the action partially opened, the extractor is first pushed out to the usual distance in the ordinary manner. The extra arm of the fallen tumbler (Fig. 2 A), then lies on the projection from the lump shaded in Fig. 4. As the breeches rise, the extra arm of the tumbler (Fig. 2 A) slips suddenly down over the lump and engages the shaded end of the ejector, giving it a blow which reacts on the other end above also shaded in the second position, and flips out the single extractor with the empty case. The impetus thus given depends on the force of the mainspring, which is sufficiently strong to throw out the case clear of the gun. If both barrels are fired both ejectors are acted on simultaneously, the tumblers being both released; while if neither is fired the opening of the action merely brings out the loaded cases in the ordinary way.

As I have before remarked, I do not see the great advantage of an ejector, but still I cannot help admiring the great ingenuity displayed in the above. My only regret is that it has no automatic blocking safety bolt.

I am informed that this gun can also be made with side locks as well as with hammers.

## SECTION IV.

### Hammerless Locks.

At page 127 I have given a description of the lock as it is generally suited to effect the explosion of the cap. I must now allude to the special provisions necessary for that purpose in the hammerless gun.

There are mainly three forms in which this kind of lock is constructed. 1st. That adopted in the Anson and Deeley and "Umpire" locks, in which the limbs are entirely lodged in the action body. 2nd. That in which they are built on the top of the trigger plate; and, 3rdly. That in which the ordinary side lock-plate is employed for their lodgment, which is again sub-divided into the bar and back-actioned forms.

(*a*) The Anson and Deeley lock is fully described in principle at page 127, and again in reference to its position in the action at page 185. There is consequently no need for any further reference to it.

(*b*) Those locks which are built on the trigger plate are necessarily all more or less modified by the respective actions to which they are applied. They are described accordingly with, 1st, Messrs. Gibbs and Pitt's original gun; 2nd, Messrs. Lang's gun; 3rd, that of Mr. Grant; 4th, Mr. C. Lancaster's four-barrelled gun; and 6th, the Ejector guns—except that of Mr. Greener—which has the Anson and Deeley lock somewhat modified in form.

(*c*) The sidelock-plate guns, on the contrary, are in many cases interchangeable. Thus, the back-actioned locks of Messrs. Scott, and that used in Messrs. Gibbs' underguard lever gun, might be easily substituted one for the other, if the actions are made to receive them. They include also in this form the lock of the *Field* hammerless gun, and the "Acme" of Mr. J. Woodward. The bar-locks used are those of Gibbs and Pitt's action, as now made in large

numbers at Birmingham, and described at page 229; also as modified by the addition of Scott's safety bolt, and described at page 231, Messrs. Woodward's ("Automaton"), Mr. Tisdall's, and Messrs. Rigby and Bissell's; Mr. Greener's side lock, and Messrs. Tolley's "Perfection." In addition is the lock of the Purdey gun, and also two recently invented by Messrs. Jones and Penn and Mr. Rogers (see page 224*a*).

With the exception of the last named and those used with the Purdey and Charles Lancaster four-barrelled guns, no rebounding lock is adopted with any hammerless gun as far as I know, nor can I see the advantage of it, except to relieve the cocking. In Messrs. Purdey's action the intention is to facilitate the cocking by carrying it out while the rebound limb of the spring is rendered inert for the time being; and in the Charles Lancaster action the object is to avoid the danger of the gun being left at full cock in the interval between the shots, and no doubt for these purposes the rebounding lock is admirably suited. But where safety bolts must be used, as in the ordinary hammerless gun, the rebounding lock would have no advantage whatever, while the disadvantage always attending the rebound would accrue, viz., the tendency to miss-fire. In the hammered gun this tendency is admitted, but it is more than counterbalanced by the advantages attendant on its greater safety, and therefore the lock is universally employed, *malgré* the extra difficulty which the gunmaker has to meet in so regulating its action as to reduce the miss-fires to a minimum.

On the other hand, the hammerless lock is often constructed with so short a throw from full cock down to "bearer" that miss-fires occur even more frequently than in the rebounding lock: and this is specially apt to happen with lever-cockers unless, as in the Gibbs and Pitt lock, the throw is beyond the average; and, indeed, if this were not so in it, miss-fires would be far too common, on account of the lever cocking,

which in all cases accompanies it, and notably with the top lever. On comparing its throw with that of the Anson and Deeley, it will be seen that it is nearly double; but then the main-spring of the latter is so strong that practically it will meet with a missfire less frequently than its weaker rival, although the latter is provided with a throw of double its length.

## SECTION V.

### The "Head" of the Hammerless Gun.

In the early days of the breechloader "a good head" was regarded as one of the most essential points in every proposed plan, because the stock was only kept sound by the entire condition of this part; and with most hammered guns the same state of things still continues. But with hammerless guns, the trigger plate, with or without side-lock plates, is so firmly screwed to the tang of the break-off, that a smaller substance of wood suffices, and greater liberties can fortunately be taken with it for the introduction of safety bolts, which would otherwise be objectionable on this account. When side lock-plates are introduced, they are firmly screwed to the break-off and to the trigger plate, so that they present an additional bearing for the wood, and enable the stock to sustain the recoil attending on the successive discharges of the gun without injury. When they are used, there is always a considerable thickness of wood between the locks taking the breech screw and carried up to the break-off, and when the locks are built on the trigger plate there is generally enough on each side to have the same effect. For these reasons we seldom hear in these days of the head giving way; but, no doubt, when the "hand" is too much reduced in size, it will sometimes break across, and this is especially the case when an attempt is made to have this part in back-actioned locks conforming to the size usually accompanying the bar lock, as is sometimes done (see page 102).

## SECTION VI.

### Safety Bolts for Hammerless Guns.

I have already, at page 132, treated of the objects for which the safety bolts are required, and I have also alluded to several which are peculiar to some of the various actions described in Section III. It is now necessary to mention those which are capable of being applied to hammerless guns generally.

Those which have been already described are (1) the *Field* safety bolt, which can only be used with the *Field* action; (2) Anson's new safety bolt and that of the Westley-Richards Company; (3) Powell's bolt, also applied to the Anson and Deeley lock; (4) Scotts' safety bolt, which requires a side-lock; (5) Tolley's safety bolts, which can only be applied to their own gun-lock; and (6) Rigby and Bissell's, which is also confined to their own action. I now come to

### Silver's Automatic Safety Bolt.

When first this bolt was submitted to me it was fixed closely beneath the tang of the break-off, as in the annexed cut (Fig. 1), in which a hammer such as that of Messrs. Woodward is bolted, and unbolted by pressing the thumb on D, when the whole assumes the position in Fig. 2, and at the same time a trigger bolt is withdrawn from the triggers, also indicated in the same figure. It will be seen at once by those who were sportsmen in the days of Joe Manton that it is a modification of the bolt introduced by him, and described at page 132. That bolt was, however, placed below the grip, instead of above it, as in the original "Silver" bolt; but it was open to the objection that it only locked the triggers, and that consequently the gun was liable to jar off in loading with the ramrod. To this position of the bolt there are two objections. In the first place, as the thumb piece D must be very loosely fitted into the tang, in order to allow it

to play freely, it readily admits water to the locks, for, being on the upper side of the gun, it allows the rain to run in by

FIG. 1.—WOODWARD'S ACTION, WITH SILVER'S TOP BOLT AT "SAFETY."

its sides, while if the gun is reversed it will run in at the trigger plate by the side of the triggers. But a still more fatal objec-

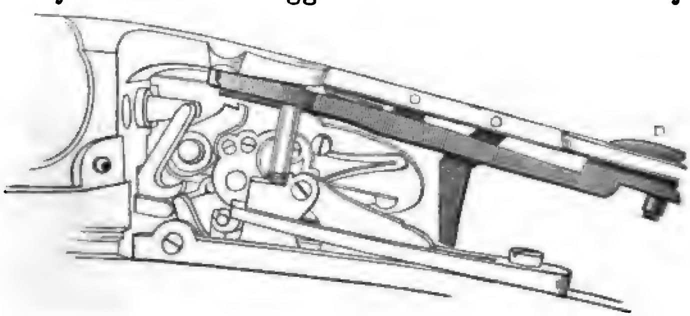


FIG. 2.—SILVER'S TOP SAFETY BOLT, AS APPLIED TO WOODWARD'S AUTOMATON GUN, RAISED FOR FIRING.

tion to it lies in the fact that when the gun is opened for loading it is almost impossible to avoid pressing on the thumb piece in

closing it, at the very time when the bolt is most wanted, that is to say, when the jar-off of the scear is likely to take place. For these reasons I strongly advised Mr. Silver to apply his

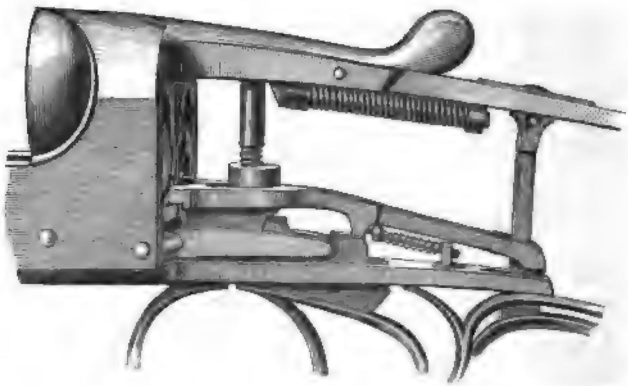


FIG. 3.—MR. SILVER'S TRIGGER GUARD SAFETY BOLT AT SAFETY.

bolt below in the position adopted by Joe Manton, as explained at page 133, and he has carried the plan out in the most admirable manner. In this position it is easy enough to grasp

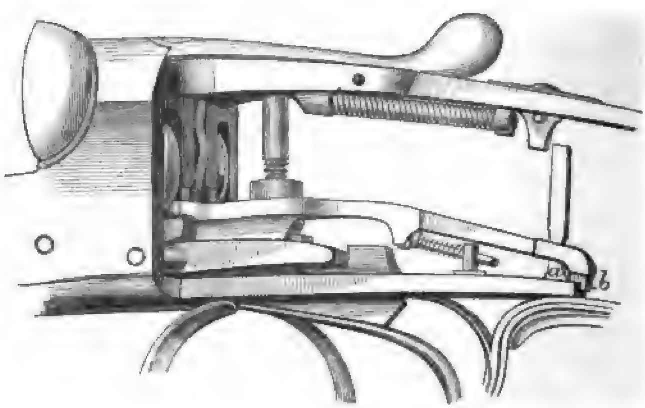



FIG. 4.—MR. SILVER'S TRIGGER GUARD SAFETY BOLT READY FOR FIRING.

the "hand" behind the bolt in closing the action, and, as it is usual in carrying a gun on the shoulder to have the trigger guard upwards, there is no necessity for any contrivance to

keep the bolt fixed. In this improvement a small lever is hinged to the trigger plate, and in grasping the "hand" it is almost impossible to avoid compressing it, and thereby acting on a cam at *a b*, Fig. 4, by which the safety bolt is brought away from the tumbler. A top slide automatically bolts the triggers, as in Fig. 3, and must be pushed out of gear, as in Fig. 4, in the usual way before the gun is fired, but the tumbler block is always in action till the trigger is pulled, unless the guard lever is raised by grasping the "hand" as in passing the gun from loader to shooter, when it is difficult to avoid it.

Lastly, Mr. Silver has modified his bolt to suit the Gibbs and Pitt action, by fixing a stud on the side of the tumbler, as shown at Fig. 5, *b*, between which and the bridle an arm is thrust (as shown in *a*), which is drawn back on pulling the trigger.

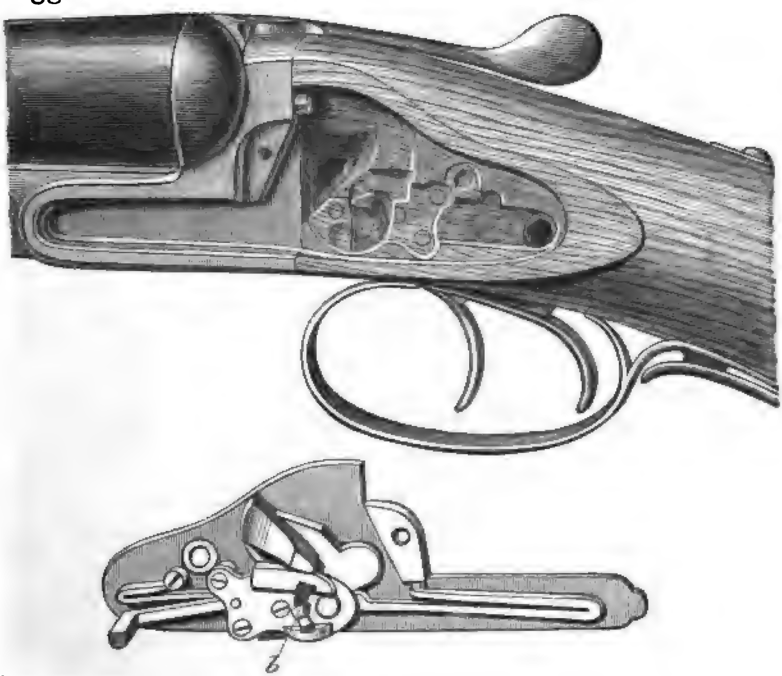



**Fig. 5.—Mr. Silver's Side Lock Safety Bolt with "Silver" Stud added.**

### Messrs. Jones and Penn's Safety Block and Trigger Bolt.

This bolt, recently protected by the inventors, is mainly intended to serve as a safety for the Gibbs and Pitt action, which seems to be very much in demand, even without such an efficient protection. It is also applicable to bottom levers by a slight alteration. It consists of a blocking bolt (*a*, Figs. 1

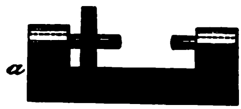



Fig. 1.—Blocking Bolt.

and 2) hung behind the strikers, and capable of being raised on its centres so as to lift it from the front of the tumbler by moving the slide *c* forward, which also takes the perpendicular limb *b* of the sliding rod, off the cross-piece of the scear, when it becomes amenable to the pull of the trigger. This bolt is

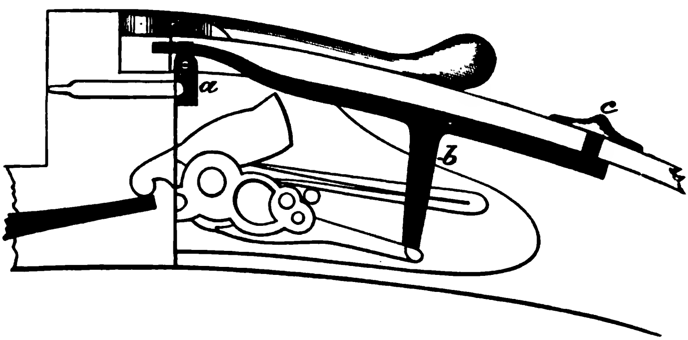



Fig. 2.—Side View of Messrs. Jones and Penn's New Safety Bolt.

certainly well adapted to the Gibbs and Pitt action, but will also serve its purpose almost as well in any other. It is automatically put from firing to safety by the bearing of the top lever on its prolongation forward, as shown in the engraving. The only possible objection to it is that, in common with all scear bolts, it cannot be made to bear dead on the scear, as that limb must be raised out of the bent when the bolt is auto-

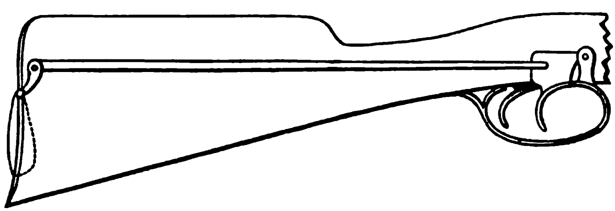
matically applied to its cross piece, which is done before the cocking is fully effected; but it can just as readily be applied to the triggers.

### Mr. Greener's Tumbler Bolting Safety Bolt.

After making several attempts, none of which satisfied him, and in order to accommodate some of his customers "who believe in automatic safeties," Mr. Greener has fitted to his guns either the trigger bolting safety described as Anson's at page 186, or the above, which bolts the tumblers by the movement of the top lever. It is, however, a very unsightly bolt, and, its more definite description may well be omitted, especially as Mr. Greener has lately produced a better one (see page 188).

### Mr. Greener's Butt Safety Bolt.

Mr. Greener also makes his butt safety bolt, which bolts the back of the triggers until the butt is pressed by the shoulder, a projection in the heel plate being then driven in, and drawing a long rod backward. This is a very poor substitute for the Silver bolt, which it resembles in principle, and, moreover, only bolts the triggers. Its construction will be readily understood on referring to the engraving.



Mr. Greener's Butt Safety Bolt.

## SECTION VII.

### Detectors or Indicators.

Various plans have been devised for indicating which barrel has been discharged, but with one exception they all let in the

water to the lock. The usual plan is to make the tumbler when down on the striker press up a small stud which falls when the tumbler is cocked or the reverse, and this of necessity allows water to reach the tumbler. Messrs. Scott have, however, introduced a most efficient and simple plan, in which a small circular plate of glass is let into the lock plate opposite the head of the tumbler whose position is thus indicated, and rendered more apparent by being gilt. This indicator is shown at pages 194 and 195, and is really a very excellent one.

# CHAPTER VIII.

## CHOOSING A HAMMERLESS GUN.

Having in the preceding pages described the various hammerless actions in the market, I must now proceed to discuss the comparative merits of each under the following heads, viz.: 1. Barrel cocking *v.* lever cocking. 2. Choice of safety bolts. 3. Strength and safety of action. 4. Facility of manipulation in loading and use. 5. Appearance. 6. Paper *v.* brass cartridge cases. 7. Choke *v.* cylinder barrels. 8. Large bore *v.* small. 9. Length of barrels. 10. Material of barrels. 11. Detectors. 12. Hammered *v.* hammerless guns.

### SECTION I.

#### Barrel Cocking *versus* Lever Cocking.

A careful examination of the guns hitherto described will show that with the exception of the Lancaster four-barrelled gun—which is cocked like a revolver, immediately before firing—all are cocked in one of two ways: first, by the force generated by the fall of the barrels; or, secondly, by the pressure of the hand on the action lever before the barrels begin to fall. It becomes now necessary to consider the advantages and disadvantages attending on each.

#### Barrel Cockers.

The list of hammerless guns, in which the cocking is effected by the fall of the barrels, includes among those already described, 1, the Anson and Deeley; 2, the *Field* gun; 3, Messrs. Scotts' patent; 4, Messrs. Gye and Moncrieff's gun;

5, Messrs. Lang's barrel cocker; and, 6, Messrs. Purdey and Sons' action. To these may be added 7, an action patented by Perkes in 1878, in which a notch in the lump lifts a projection from the tumbler, closely resembling one of Lang's patents; and 8, a very complicated arrangement, patented by Mr. Bonehill in 1878, which I believe has never been carried out. Also 9, Mr. Rogers' action and Mr. C. Lancaster's Ejector gun.

The advantage of barrel cocking is that it allows a lock main-spring of full strength, thereby insuring the absence of miss-fires. *Per contra* is the objection that as (excepting in the Purdey gun) some extra force is required beyond that for simply opening the gun, the hinge has to sustain a strain above that which it would otherwise bear; and the hinge being, with one exception (that of the *Field* gun), cut in two, the strain causes wear and tear in an otherwise weak part. The Purdey gun is not amenable to this objection, because the extra strain necessary for the cocking is put on in closing the gun, and in this respect its action is undoubtedly entitled to a very high order of merit.

### Lever Cockers.

These include, among those described above: 1, Murcott's; 2, Gibbs and Pitt's; 3, Messrs. Woodward's Automaton (London); 4, J. F. Woodward's Acme (Birmingham); 5, Lang's Lever Cocker; 6, Tisdall's; 7, the Umpire; 8, Rigby and Bissell's; 9, Grant's gun; 10, Greener's Sidelock; 11, Messrs. Tolley's Perfection; and 12, Cogswell and Harrison's Desideratum, in common with the other varieties of Gibbs and Pitt's action. In addition to these I may mention Needham's and Greener's self-ejectors. With regard to advantage, all that can be said in favour of this form of cocking is that it effects its object with less straining of the hinge than in the barrel cocker.

On the other hand, it is open to two objections: first, that it is liable to misfires if the lever does not snap home or is not pushed home; because, in that case, the striker is arrested by the lever, and must carry it home before it can break the cap; and, secondly, to reduce the amount of force necessary for moving the lever, the lock mainspring must be weaker than in the barrel cocker, again increasing the chance of a missfire. For the latter reason the under guard lever is much better than the top lever, and, in my opinion, is also more convenient, the hand being ready for removing the cases as soon as the lever is depressed; and, moreover, the downward pressure tending to lower the stock and open the breech.

To demonstrate the ill effect of the lever cocking process, especially in the top lever, it is only necessary to watch the lever when the trigger is pulled, when, if it is not quite home, it will be seen to be driven home by the blow, absorbing a large proportion of the force of the mainspring, and often leading to a missfire. In the under-guard lever, its spring being stronger and always forcing it home, no such motion is usually perceptible.

## SECTION II.

### Choice of Safety Bolts.

Of those bolts whose use is confined to the special actions of their inventors it is needless to say anything in this place, and my attention is therefore confined to the Silver, Scotts', and Jones and Penn's bolts, which can be applied to any gun in the first and third cases, and to any side-lock in the second. Between the two first there is little choice, both being fully up to all their required duties, but, if a selection must be made, I should give the preference to the Scott bolt, first, on account of its less interference with the wood of the stock, and secondly, for the following reasons: In both cases a jar-off of the scear in loading is fully guarded

against; in both the triggers are automatically bolted; but in the Scott intercepting bolt, the two being quite independent, the second barrel is guarded from a jar-off caused by the firing of the other, which is not done in Mr. Silver's bolt until the pressure of the hand is taken off, after the explosion. This accident seldom happens in a shot gun, but it is common enough with the Express, or large bore rifle, in which the jar is greater than in the shot gun. Nevertheless, it does sometimes happen in the latter, and it is well that it should be prevented if possible. With regard to the various bolts applicable to the Anson and Deeley action other than that finally adopted by the Westley-Richards Company, and described at page 186, I can only remark that the latter is at least equal to its rivals, and quite comes up to my standard.

It is a subject of much congratulation that gunmakers are generally coming in to my views on the safety bolt, and I am proud of the latest convert in the shape of Mr. Deeley. There is, however, a formidable quartette still holding out, viz., Messrs. Purdey and Co., Mr. Stephen Grant, Mr. C. Lancaster, and Mr. Gibbs, of Bristol. Bishops do not now make their appearance at the battue, so that we cannot expect the conversion of the above gunmakers from the death of such a personage, as is often predicted with regard to railways; but possibly a duke or an earl may serve the cause equally well, and I expect some day to hear of such a catastrophe converting one or more of those who still hang out.

## SECTION III.

### Comparative Strength and Safety of the Various Actions.

This very delicate question, involving important commercial interests, ought not to be considered settled by a mere opinion, unsupported by a long series of exhaustive experiments,

which are quite beyond the powers of any individual. I shall not, therefore, attempt to make any selection, but shall content myself with the remark that, for our present purpose (the consideration of shot guns not exceeding 12-bores), any one of the several back actions is strong enough without a top connection, but that, if bar-lock actions are used, this protection should be provided. In this opinion I am opposed to that of the celebrated Mr. Jas. Purdey, and no doubt with his careful selection of materials and supervision of workmanship, a bar-lock action provided only with his well-known bolt is sufficient; but as a general rule, and especially in cheap guns, my advice is to insist on one or the other, viz., either a back-action lock, or, if a bar lock, then a top extension. I am on the other hand supported by the equally high opinion of Mr. Stephen Grant, who objects to bar locks for the same reasons as myself. With a Purdey bolt, well fitted, and a doll's head even without any catch in it, a bar-lock action is, in my opinion, quite safe with average metal and workmanship.

## SECTION IV.

### Facility of Manipulation.

In the present day no gun is considered good enough for battues which has not a snap action, but for general shooting the double grip is quite enough. The demand for a quicker loader than the snap, by means of a self-ejector, is in my opinion unfounded, but nevertheless there are many sportsmen who think highly of Mr. Needham's gun, and others who follow Mr. C. Lancaster and Mr. Greener in their improvements on that ingenious invention. In facility of use everything depends on the gun "coming up" well to the eye, on which I have dilated at pages 101, 102, and also at pages 155, 156, in alluding to machine-made guns.

## SECTION V.

### Appearance.

In this respect the London gunmakers have long held the pre-eminence, and indeed until within the last ten or fifteen years, with the exception of Mr. Westley Richards, no gunmaker out of London could produce work approaching in appearance to that of the celebrated Oxford-street firm and one or two of their competitors. Their guns had, and indeed still have, an indescribable look about them which high-class sportsmen value almost above performance, but at all events up to that standard. Lately, however, Messrs. Scott, Greener, Webley, Tolley, Powell, Turner, and others of almost equal note at Birmingham, have emulated the Westley-Richards Company in turning out work of a high class, and to this list I may add Messrs. Bland and Sons, whose improvements on my humble efforts with the *Field* gun have been carried out in a highly meritorious way. Still it cannot be denied that the guns of Messrs. Purdey and Sons catch the eye of the connoisseur, and that their work is ahead of all their competitors in appearance, though no doubt very hardly pressed by some of those Birmingham firms I have named, and in London by Grant, Rigby, C. Lancaster. Holland and Holland, Lang, and one or two others.

## SECTION VI.

### Paper *v.* Brass Cartridge Cases.

This subject is still *sub judice*, so that I shall only refer my readers to Chapter IX., in which it is fully treated of. I may, however, state that the evidence in favour of brass is so strong as to satisfy me of the superiority of the metal case. In selecting a gun this point should be well considered, but

even if the paper case is preferred, and a gun ordered with chambers to fit it, it is only necessary to re-bush the chamber, at a cost of from 1*l.* to 1*l.* 10*s.*, if afterwards a change is desired.

## SECTION VII.

### Boring—Choke *v.* Cylinder Barrels.

On this point the intending purchaser should be guided by a knowledge of his own powers of shooting. Curiously enough, on inquiring from several different firms, I find the proportion of their sales to vary from one choke to five cylinders, to four chokes to one cylinder, so that it is difficult to arrive at any conclusion founded on actual results, as to the proportion in which the two kinds of boring are now adopted. One gunmaker will tell his customers "a full choke will blow your birds to pieces," while another will say, "by all means have one choked and the other modified—blowing to pieces is a delusion." Now I certainly can indorse the latter opinion, for, after carefully examining both game and pigeons shot by each kind of boring, the difference is not to be distinguished, at all events without dissection. This will be rendered apparent on examination of the following diagrams, which are all constructed from the actual numbers on the 10-inch plate of the force-gauge with each kind of shot. The proportion between the plate and the circle varies a good deal according to the boring of the gun. Thus a very full choke will often put one quarter of its charge on the 10-inch plate, while a cylinder will seldom put more than one-fifth. I have therefore taken the numbers from actual experiments, those of the choke being founded on Mr. Jones's trial of the three kinds of powder in which his gun put 222 into the 30-inch circle on the average, and 48 into the 10-inch plate. This excellent distribution is in great measure dependent on the brass cases which were used by him, as generally

with a pattern of 222 the 10-inch plate will receive more than 48 pellets, and often as many as 70 or 75.

Each page of the series represents as nearly as may be half of the 10-inch plate, and of course half the number of pellets put on it in each case, supposing them to be equally distributed. Now, begining with Fig. 1, we find that a grouse or partridge would receive 5 pellets of No. 6 from a full choke with a well-distributed pattern at 40 yards, which is certainly not too many to ensure a kill. Fig. 2 gives 3 pellets as the number resulting from a modified choke; and Fig. 3 shows only 2 pellets as reaching a bird of this size, from which many a one would escape. In Fig. 4, the proportion of No. 5 shot hitting one of these birds from a choke is the same at 30 yards as with No. 6 in a cylinder at 40 yards, namely, 3; while Fig. 5 indicates the result of firing No. 6 at a pheasant with a cylinder at 40 yards, namely, 5 pellets—again equal to a choke with No. 5 on the same bird at the same distance. Fig. 7 shows the result of using No. 6 at 30 yards with a choke, namely 6 pellets; and lastly, Fig. 8 gives the number of No. 5 pellets hitting at 25 yards in both cases, grouse or partridge.

After examining these diagrams, the intending purchaser must calculate for himself which pattern will serve him best, always recollecting that the choke enables him to get as nearly the same pattern with No. 5 as the cylinder with No. 6, so that he can at all times practically convert his pattern from choke to cylinder by varying the size of his shot, with the advantage that he thereby increases the force about one-sixth. But when doing this, he does not increase the killing circle, for the No. 5 shot cover just the same area as the No. 6, so that still the bad shot is at a disadvantage with the choke. On the whole, therefore, my advice to the decidedly bad shot is to use a cylinder only, and to others in proportion to their skill. The good shot is admitted to gain a great advantage from the choke, but he requires no advice from me.

Fig. I. Nº 6 Shot at 40 yards, CHOKE – 48 pellets on 10 in. 220 on 30 in.
5 shots on Average size of Grouse and Partridge.

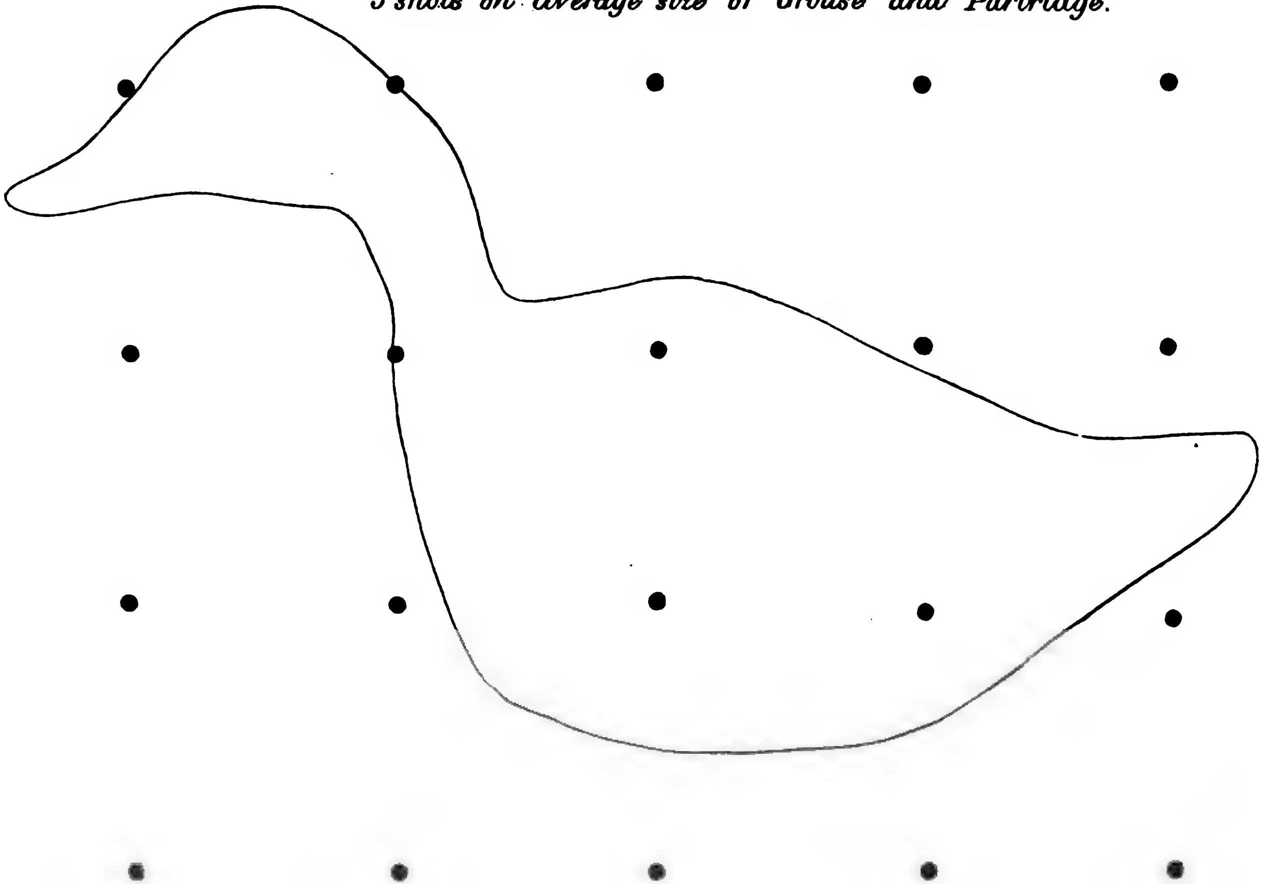


Fig. 2. No. 6 Shot. at 40 yards, MODIFIED CHOKE — 41 on 10 in. 170 on 30 in.
3 shots on Average size of Grouse and Partridge.

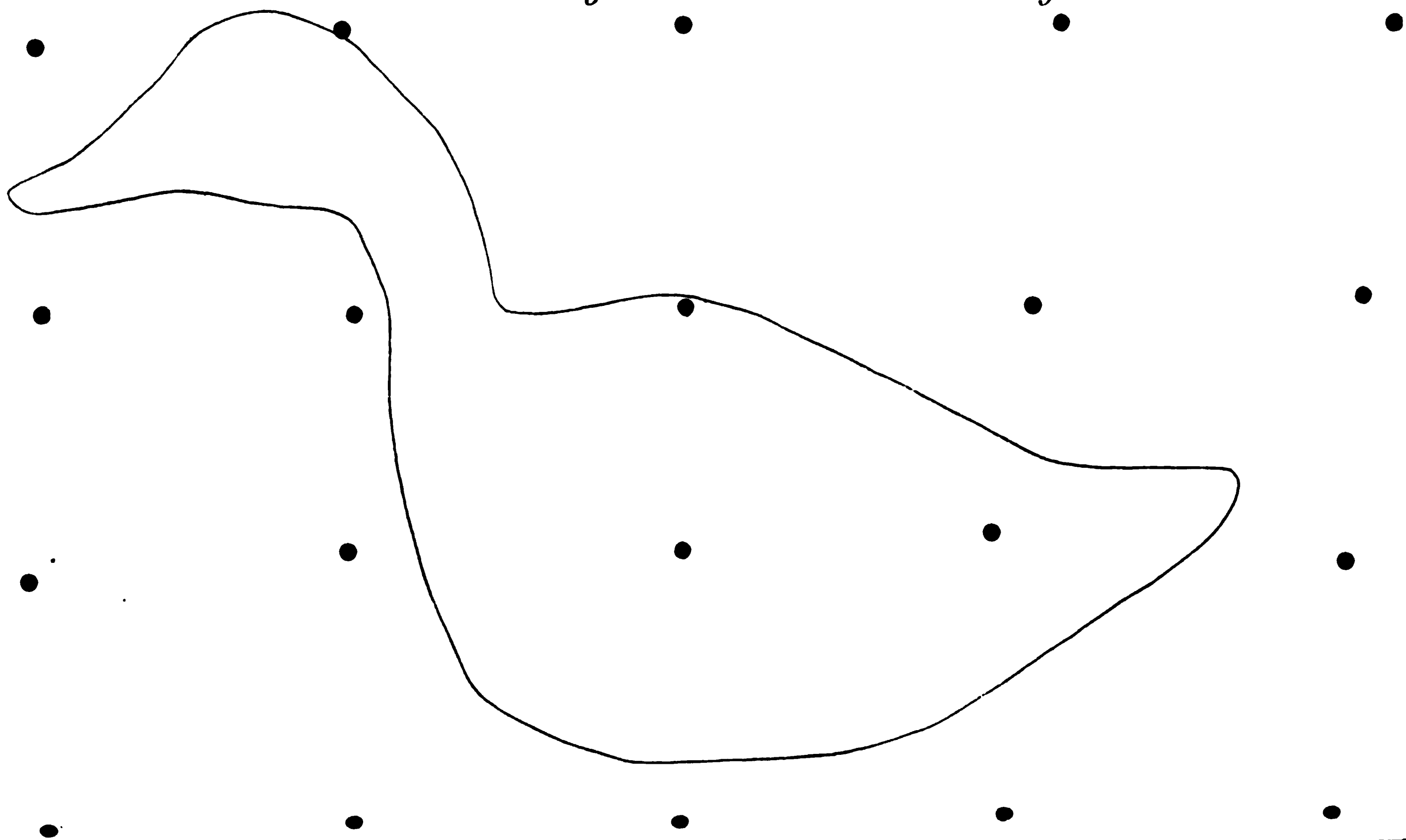


FIG. 3. Nº 6. *Shot, at 40 yards,* CYLINDER – *28 on 10 in. 130 on 30 in.*
*2 shots on Average size of Grouse and Partridge.*

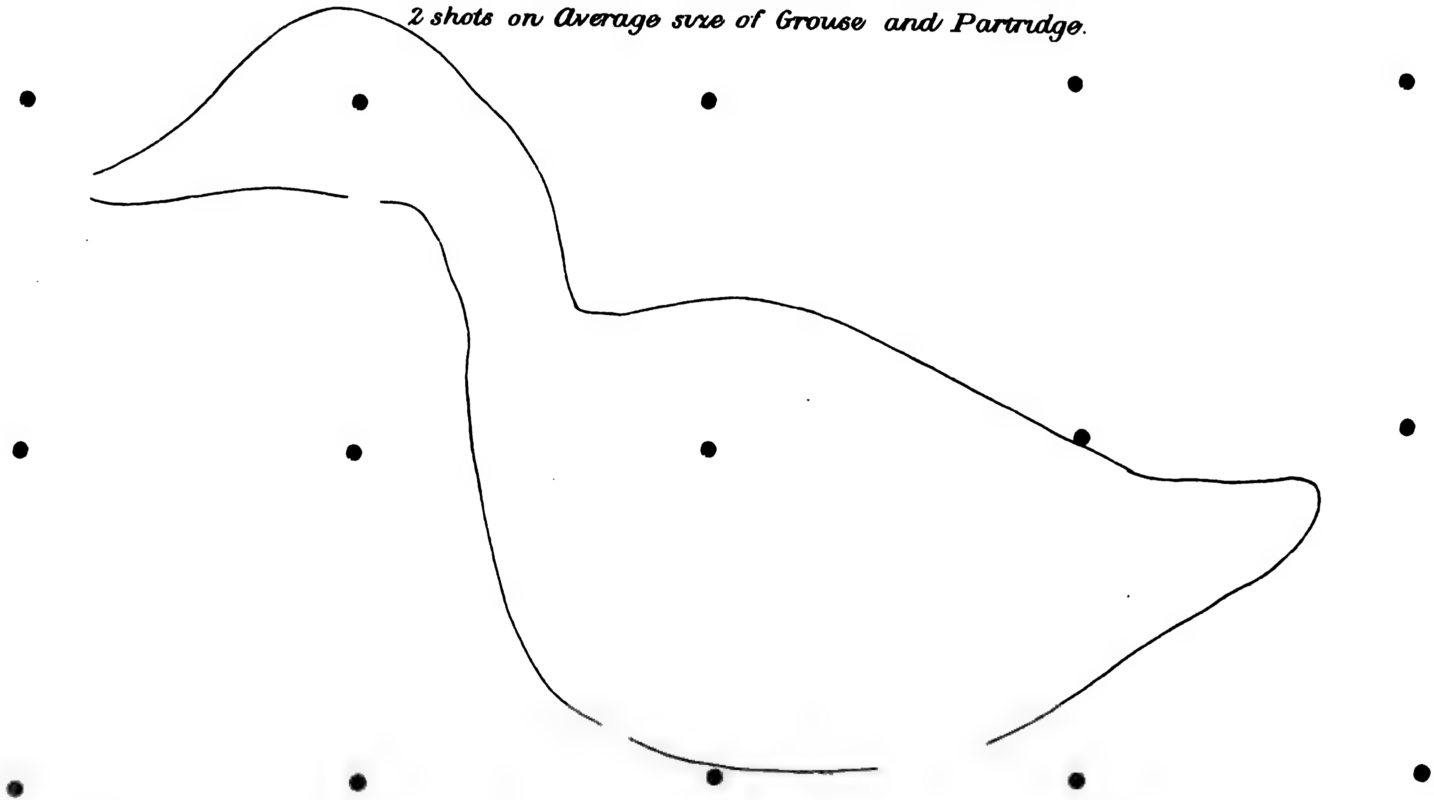


Fig. 4 N°5 Shot, at 40 yards, CHOKE – 28 on 10 in. 130 on 30 in.

3 shots on Average size of Grouse and Partridge

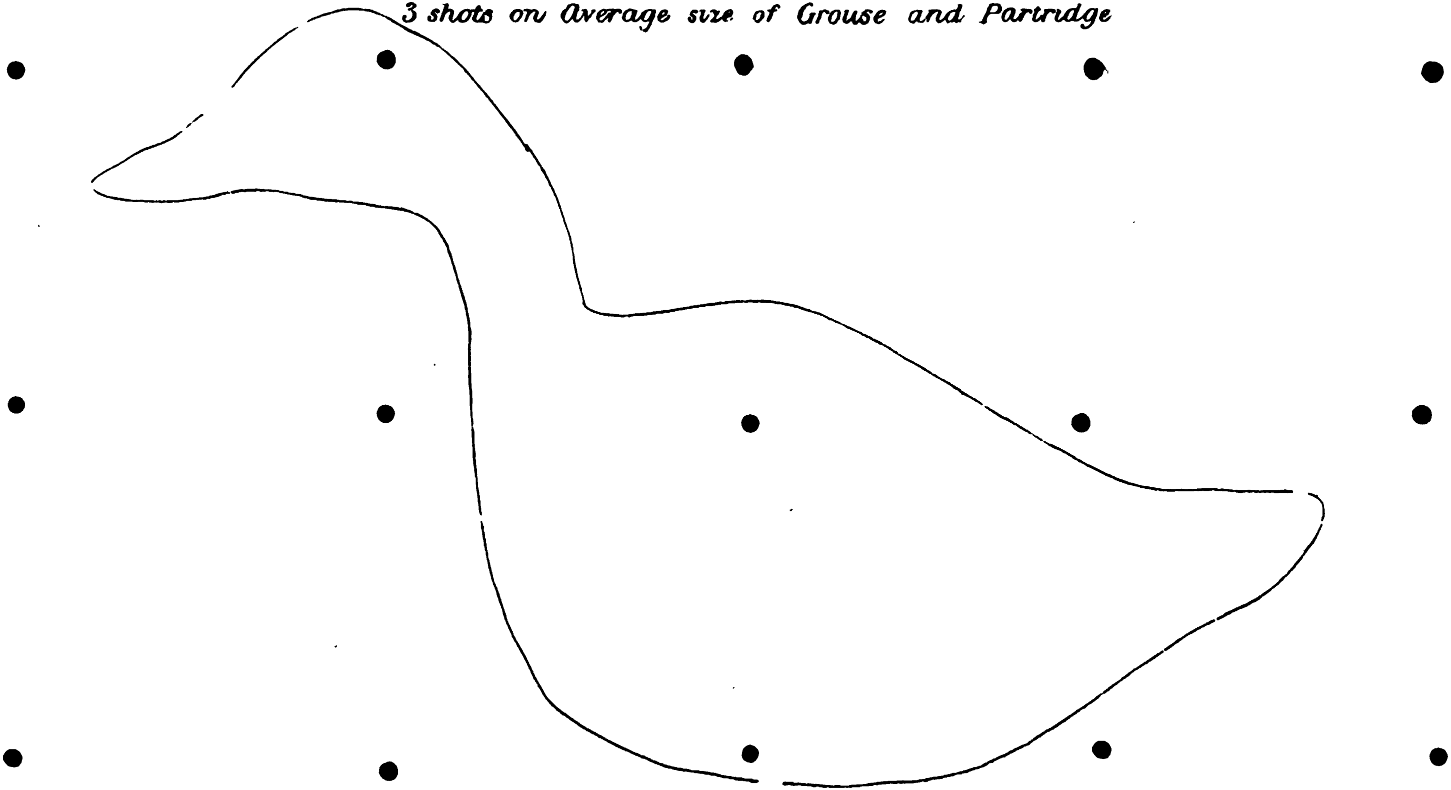


FIG. 5. No. 6 Shot, at 40 yards. CYLINDER—28 on 10 in. 170 on 30 in.
5 shots on Pheasant.

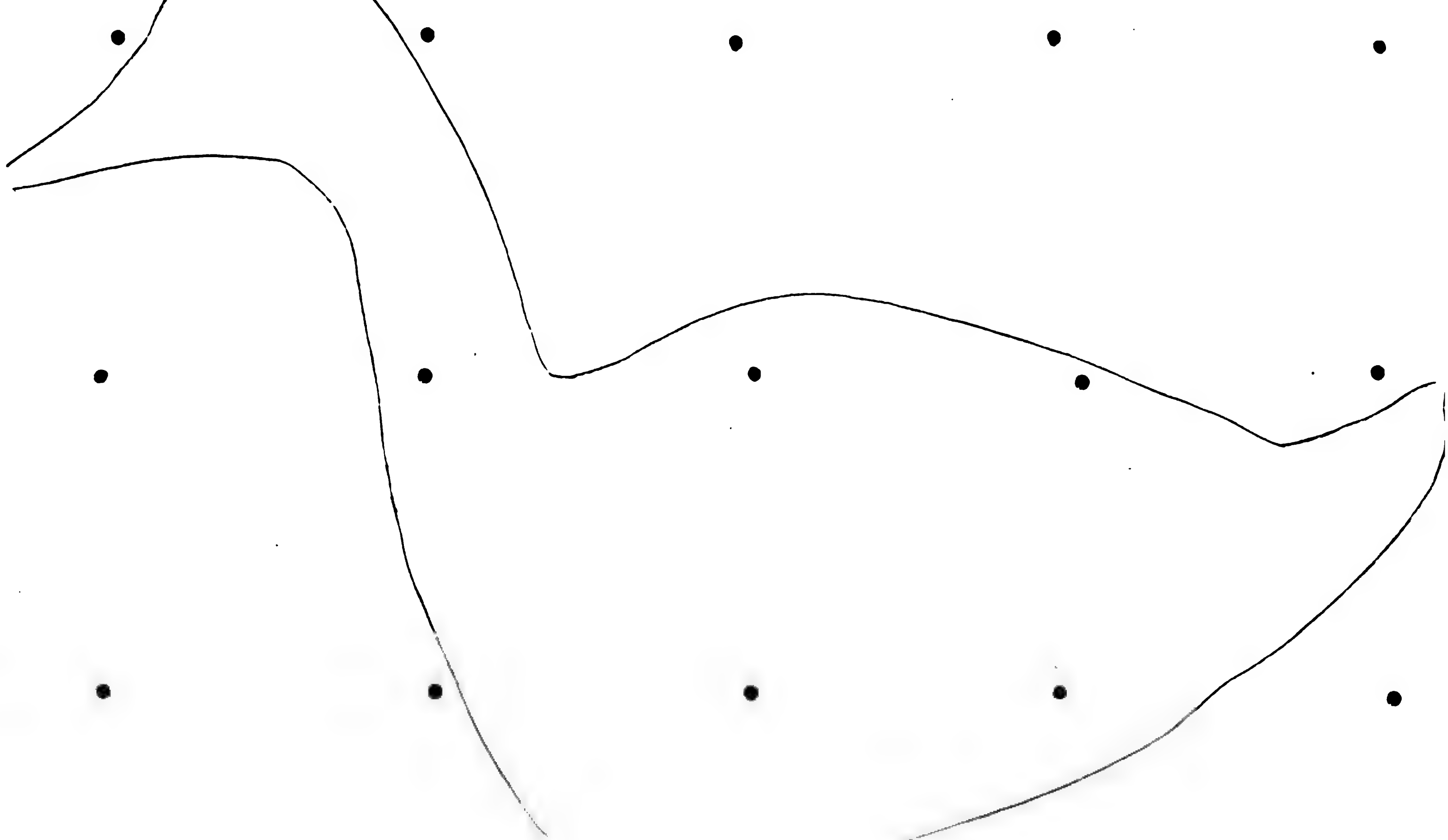


FIG. 6. No. 5 *Shot, at 40 yards,* CHOKE,—*28 on 10 in. 170 on 30 in.*
*5 shots on Pheasant*

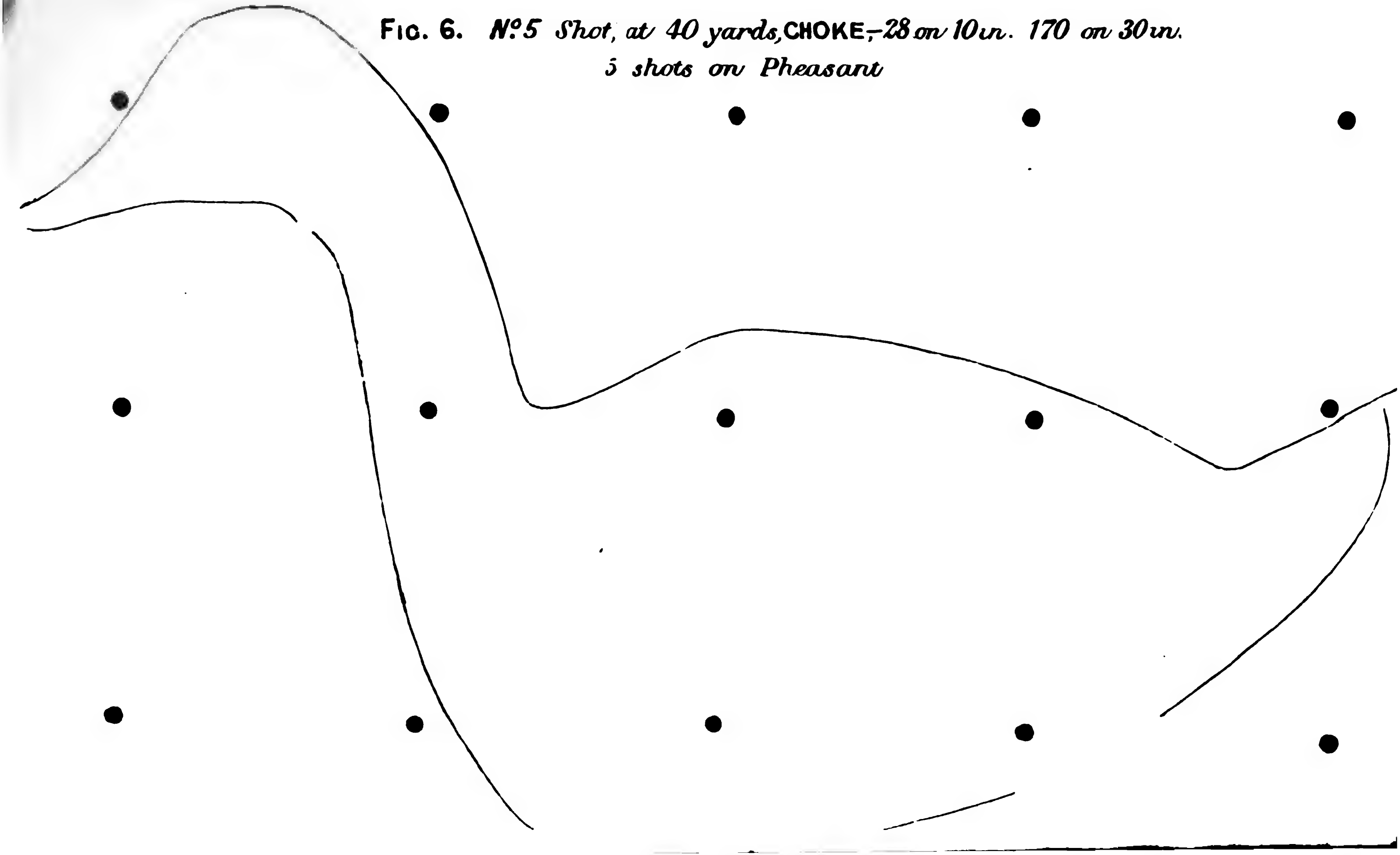


FIG. 7. *No. 6 Shot, at 30 yards,* CHOKE–*66 on 10 in. 310 on 30 in.*
*6 shots on average size of Grouse and Partridge.*

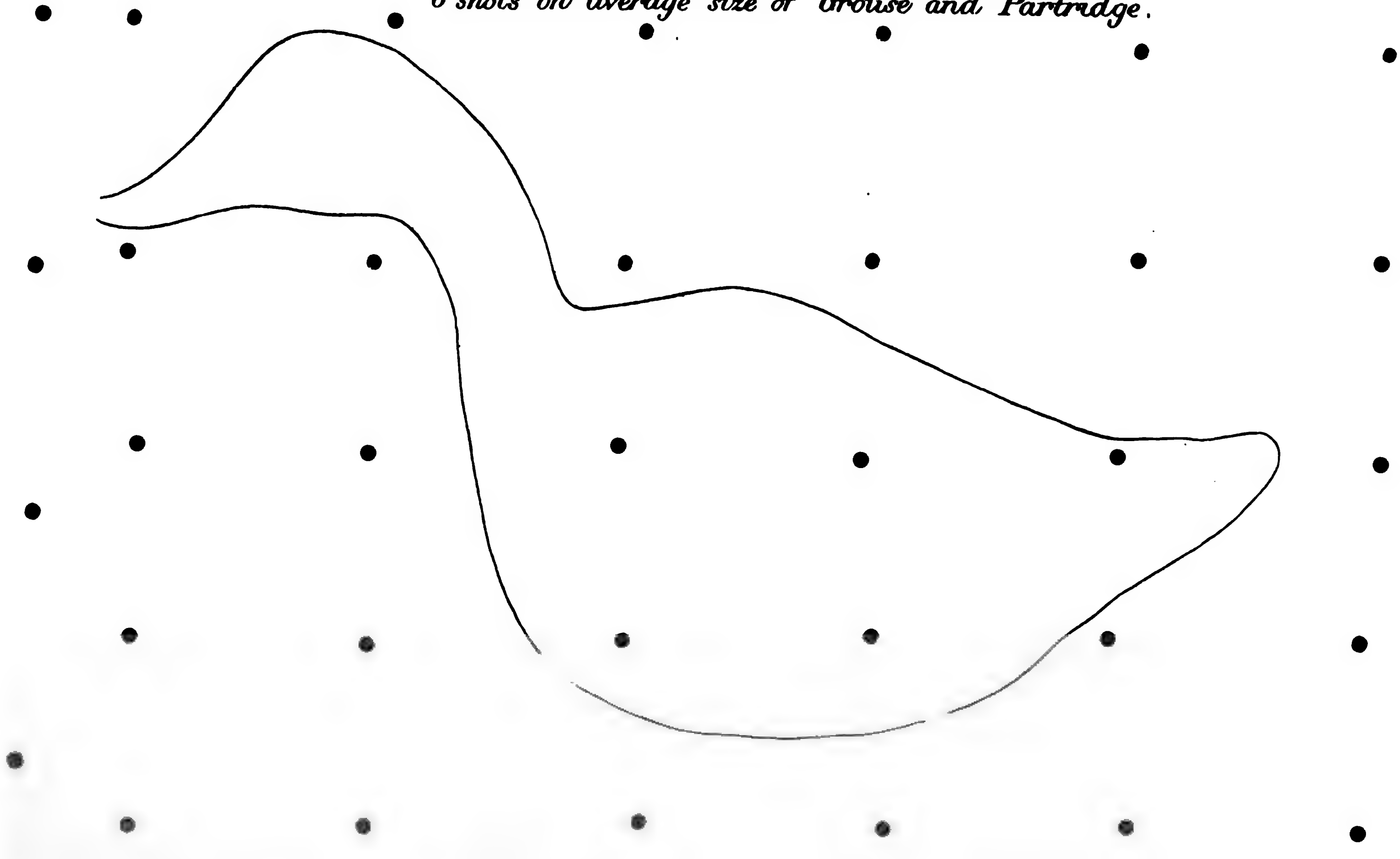
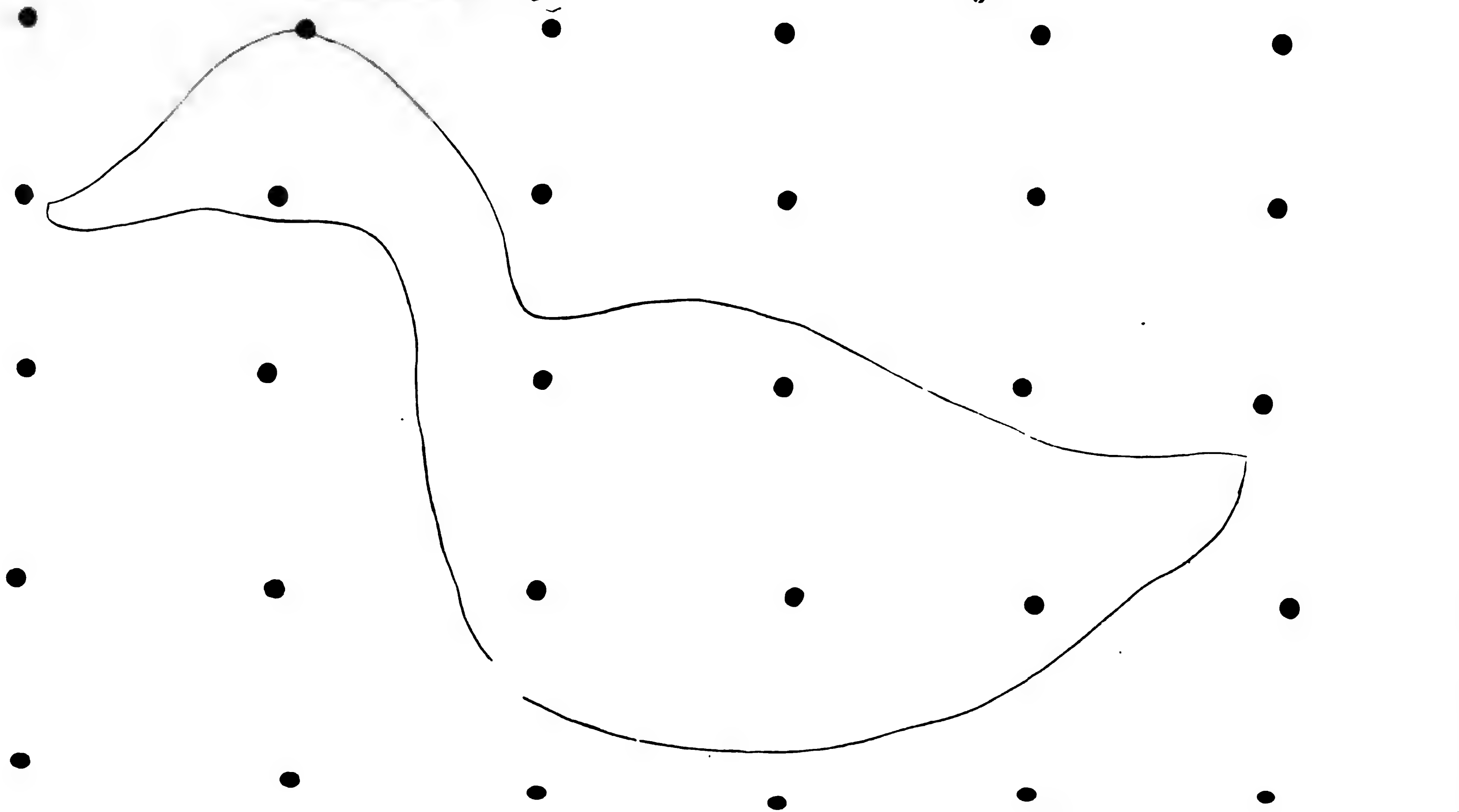


FIG. 8. *No. 5 Shot, at 25 yards,* CHOKE - *66 on 10 in. 220 on 30 in*
*5 shots on Average size of Grouse and Partridge*



## SECTION VIII.

### Large Bores v. Small.

Here the question is solely one of weight, for there is no doubt that, irrespective of that element, the larger the bore the better is the result. Game shots, however, in this country confine themselves chiefly to 12, 16, and 20 bores, and practically therefore the choice is limited to these three. I have already discussed, at pages 68, 69, the result of the trial of 1879, in which the superiority of the larger bores, *per se*, was plainly manifested, so that it is needless for me to return to the subject. But where the shooter is unable to carry a 7lb. gun, or even 6½lb., he had better take to a 16 or 20-bore, although his killing circle will be thereby reduced. That trial showed that the difference in force between the three bores is not very great, being respectively 227·48, 218·84, and 216·35; but in pattern the 12-bore is nearly 35 above the 16-bore, while this last is nearly 10 above the 20-bore, all being full choked. The weights of the first and second choke bores were respectively 7¼lb. and 6lb. 14oz., of the 16-bores 6¼lb. and 5lb. 11oz., and of the 20-bores 5lb. 13oz. and 6lb.; but since that time all these weights have been somewhat reduced, and I am told that Messrs. Purdey and Sons now turn out a 12-bore of the extremely low weight of 6lb. 2oz. with the aid of Whitworth steel. However, it may be broadly stated that 1lb. can be saved by using a 16-bore and 1¼lb. by the use of a 20-bore with the full length of barrels.

## SECTION IX.

### Length of Barrels.

A still further reduction can be effected by the use of short barrels to the extent of four or five ounces, probably a little

more. But though this can be done by reducing the length from 30 inches to say 24, it is attended by a loss of force or penetration, and no gunmaker will warrant the 24in. gun to compete with the 30in. at the target. In this point, therefore, over and above convenience in covert shooting, as mentioned at page 9, weight is the only reliable guide; and it may be roughly calculated that from ¾oz. to 1oz. will be saved for each inch in length that the gun is reduced.

## SECTION X.

### Material of Barrels.

Where price is no object and the gunmaker can be fully relied on, my opinion is somewhat in favour of Whitworth steel, but, as the cost is considerably more than that of stub Damascus or laminated iron, this point must be considered, while the only evidence of the steel being what it pretends to be resides in the honesty of the vendor. Between laminated iron and Damascus there is little choice in my opinion, but if anything, I should certainly recommend the former, and especially if made of Marshall's iron as described and illustrated at page 89.

## SECTION XI.

### Indicators.

There is no possible objection to the Scott indicators, described at page 231; but all others are, in my opinion, worse than useless.

## SECTION XII.

### Hammered *v.* Hammerless Guns.

Here fashion is no doubt in favour of the latter, and on the whole I think, as now made, the hammerless gun is the

superior in point of safety and efficiency. The question, however, is greatly one of fancy. With a good safety bolt like that of Messrs. Scott, the new one of the Westley-Richards Company, that of Mr. Greener, Mr. Powell, or Mr. Jones, or, lastly, the Silver (Messrs. Scott's or the Westley-Richards for choice), the hammerless gun is, I think, to be preferred. My reason for preferring the two I have mentioned is that they, and others on similar plans, insure against accident, even when the safety bolt is at "firing," so long as they are in good order, whereas the ordinary intercepting bolts do not then act, being lifted for that purpose.

## SECTION XIII.

### STRIKERS.

This necessary part of the hammerless gun is either of one piece with the tumbler, as in the Anson and Deeley, or jointed to it, as in Needham's gun, or entirely detached, as in the majority of cases. The important point is to exclude water and gas; and for some years Messrs. Bissell and other actioners have used for this purpose a striker provided with a shoulder, and put in from the face of the break-off, which greatly tends to keep the gas out of the lock, but is not entirely effectual. Mr. Leeson, of Ashford, combines this striker with the Anson and Deeley lock and action; and it certainly answers better as a water and gas check than the Anson and Deeley striker, which does not fill the hole except at the extreme end when down on the cap, and leaves it entirely open when the gun is cocked for loading, at a time when rain (if there is any) has free access to it.

# CHAPTER XI.

## CARTRIDGE CASES FOR SHOT GUNS—OTHER THAN PUNT GUNS.

### SECTION I.

#### Paper Cases.

At the time of the introduction of the Lefaucheux gun into England the pin cartridge case was the only one used, as mentioned at page 143. Soon afterwards, however, the Pottet central-fire case was invented and brought to perfection by Schneider, Daw, Eley, and others, the result soon being that a central-fire, as constructed by Eley, Joyce, and of late Kynoch, in this country, came into general use, and supplanted the pin. As usual in all valuable inventions, the lawyers were called in to settle various contending claims; but this is of little interest in the present day, and all that concerns the modern sportsman is to ascertain what form of the central-fire case suits his purpose best. In the early stages of its manufacture the paper case split, and missfires occurred too often; but these defects were soon remedied, and of late all the above-named manufacturers have been able to warrant their cases not to split, and not to missfire more than once in a thousand times, which last condition I have repeatedly ascertained by experiment to be very well carried out. At first the additional expense incurred by the use of the cartridge case was complained of, and to meet this objection a very durable one was manufactured and covered with green paper as a distinctive mark, which was capable of being reloaded on the average three or four times, but the removal

of the cap and replacing it is a troublesome process, and few sportsmen adopt it. At present four qualities are made in England, viz.: (1) Green gas-tight; (2) blue, not warranted; (3) brown, also not warranted, but serviceable for common work; and (4) buff, warranted gas-tight, and strong enough for any powder The green and buff can be reloaded several times, but the blue and brown will seldom stand that test. They are made of the following numbers, viz., Nos. 4, 8, 10, 12, 14, 16, 20, and 24, to be used when made of paper with the corresponding gauges of barrel. They are made of various lengths, those from 12 downwards being $2\frac{5}{8}$in., $2\frac{7}{8}$in., $3\frac{1}{4}$in. long to suit the charges likely to be required. Their price from 12 downwards is about 2 guineas per 1000 for the green, 1*l.* 17*s.* blue, and 1*l.* 10*s.* brown, the buff being somewhat higher in price than the blue. In their internal diameters they are usually about ·010in. larger than the bores of the corresponding numbers. Since the introduction of hammerless guns the entire retention within the case of the gas developed by the combustion of the powder has become very important. The superior kind of cases, as I have before remarked, are warranted gas-tight by their several makers, solutions of indiarubber or varnish being used for that purpose; but with heavy charges an escape will occasionally occur, and notably with quick-burning powders, such as the Schultze powder or that of the E. C. Since the manufacture of Mr. C. Lancaster's case, described at page 145, has been abandoned none of those in the market could be relied on as perfectly gas tight, until Mr. Joyce, the well-known cartridge maker, of London, brought out in the present year a case of the ordinary make, but slightly reduced in size at the base, and then this part covered with a capsule of brass. It is the invention of a Mr. Bailey, and on trial I have found it to be perfectly efficient, the capsule retaining all the gas without leading to a missfire. The make of this case will be

readily understood by examining the annexed woodcut, in which Fig. 1 shows the external appearance, and Fig. 2 the section. This case cannot, of course, be recapped and reloaded.


FIG. 1.

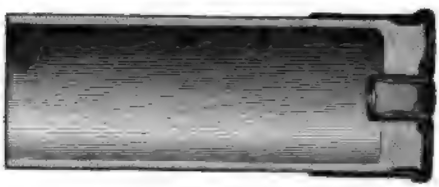



FIG. 2.
BAILEY'S GAS-TIGHT CASES.

Another plan for preventing the gas reaching the lock is carried out in the gun itself and not in the cartridge case. It was described by me in the *Field* of April 1, 1882, as follows:

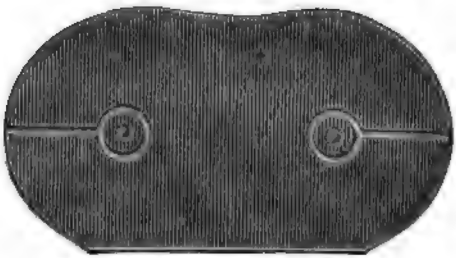
To understand the nature of this patent, it is necessary to explain that a small quantity of gaseous vapour escapes backward around the cap, and especially so when Schultze powder is used, from its greater initial pressure on explosion. When this takes place, the base of the cartridge being driven back against the face of the action, causing a gas-tight bearing between them, any escape must pass through the striker hole, having no other means of exit. The result is, that in a short time the lock mechanism becomes rusty and likely to get out of order.

The essence of this patent consists in establishing a communication between the recess in which the cap is placed and the outer air, allowing the fumes to pass off without entering the striker hole.

For a long time this question has sorely vexed gunmakers; a number of methods have been tried to prevent locks rusting, but have fallen short of perfect success. The plan adopted by Messrs. Scott is exceedingly ingenious and simple, as will be seen by the

illustration. Circular grooves are sunk into the face of the breech action, the inner edge of the groove being coincident with the outside of the caps; the gas fume is received into these grooves, and carried by one or more conduits into the outer air.

The inventor showed us a double hammerless gun on which the patented improvement had been applied to the *right* barrel *only*. An equal number of cartridges were fired from each barrel, lasting over several days. It was found, on examination, that the lock of the right barrel was perfectly bright and without the least sign of rust deposit, while the left lock had become rusty.



GAS CHECK FOR HAMMERLESS GUNS.
(W. & C. Scott & Son's Patent.)

We have not as yet tried this simple and most ingenious plan, and can only therefore give a theoretical opinion on it, which is, that it bears out Messrs. Scott's statement that in practice it has proved itself to be efficacious. We do not usually attach much importance to the experiments made by inventors in support of their crotchets; but our knowledge of the firm in question leads us in this case to believe that the locks produced by them (one of which is quite rusty, while the other is perfectly bright) are the result of an equal number of rounds (200) fired from each barrel, one striker being provided with their recess, and the other in the ordinary condition.

Since that time I have experimented with this plan, and find that it succeeds practically, though not absolutely, in keeping out gas from the locks.

## SECTION II.

### BRASS CASES.

Within the last few years brass cases, which are largely used in America, have found some support in this country,

but they have never been generally adopted here. During the present year (1882) Messrs. Kynoch, of Witton, near Birmingham, have improved on their manufacture in every respect, and I believe that their new case will be found far superior to any at present made of paper. This case, called Kynoch's "Perfect," is of the same weight as the paper case of the same gauge, can be easily made to retain its load by a machine sold for that purpose, can be re-loaded several times with facility, and costs the same as the green case. There is consequently no drawback to its use in guns constructed for the paper case; but, as far as my experience goes, *there is no advantage* in using it in such guns, except in wet weather, when the brass does not suffer like paper. When so used the brass case must be of the same outside dimensions as the paper case, in order to fit the chamber, but the metal being only seven thousandths of an inch thick, while the paper is thirty thousandths, or thereabouts, the inside diameter, instead of being ·735 inch, as in the paper case, is ·777 inch; so that it requires a wad ·042 inch larger than that used in the paper case; and, as the latter is expressly adapted to the usual bore (which is generally 13 gauge in those nominally of 12 gauge), the enlarged wad does not suit so well, and certainly, according to my experience, slightly reduces the penetration of the gun.

To make these cases of any real service the chamber of the 12-bore gun must be reduced by twice the difference between ·007 and ·030—viz., ·046 inch, and a No. 14 Kynoch case used; and when this is done a great improvement in pattern and penetration is effected. The cause of this improvement apparently is that the cone between the chamber and the barrel is done away with, a very slight shoulder being left, only ·005in. deep, nearly corresponding with the thickness of the brass used for the case. No cone is required, and the only departure from a true

cylinder is the slight "opening behind" in the breech of the barrel, which is necessary to give good shooting. I have always been of opinion that the deformed pellets, which are always found to bear a considerable proportion to the spherical ones reaching the target, are caused by the pressure which the outside pellets receive in passing from the cartridge case through the cone; and the truth of my theory is confirmed by the fact that they are almost totally absent when these brass cases are used in a gun constructed for them, while they abound as much as ever when the No. 12 "Perfect" case is used in a 12-bore gun. Attempts have been repeatedly made

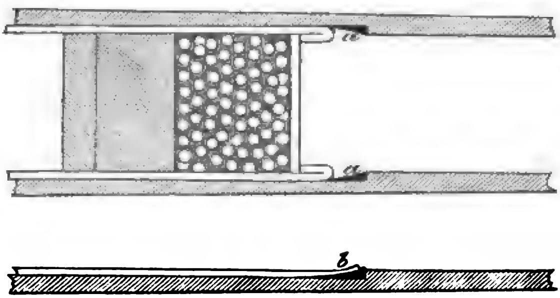



Fig. 1.—Diagram showing Fouling at Shoulder of Chamber.

in former years to cut the shoulder square, so as to fit the case when not turned down, and recently by one of the correspondents of the *Field* in 1881, who employed Messrs. Tolley to chamber a gun in that manner; but on trial it failed altogether, as the plan always has done, and for a very simple reason, viz., that the fouling, as shown at Fig 1 *a a*, collects under the shoulder, and is not squeezed forwards on each discharge as is the case when the shoulder is bevelled off, the result being that the case protrudes into the barrel as shown at *b*. The brass case, on the contrary, not being turned down, but simply crimped, pushes forward the fouling with its sharp edge as it is driven home, and no such protrusion takes place; and on this account I prefer the crimper of Mr. Greener,

or the machine of the National Arms Company to the swedge advocated by "One who has Fired." As a consequence of this clearing out the fouling, the shot travels smoothly forward without deformity, and there are scarcely half a dozen misshapen pellets in a charge of 1⅛oz. I have myself lately seen 298 pellets out of 306 (which number constitutes the above charge) put on a 40in. plate with a very full choke, which shows that the usual amount of deformity did not take place, for such a result could not be obtained with a paper case, in which at least twenty or thirty pellets always fail to reach the plate.

From my own experiments and those mentioned above I am quite satisfied of the superiority of the pattern in point of numbers and regularity effected by the "Perfect" case as compared with the paper; and in point of penetration the force-gauge tells the same tale, the increase being about three or four per cent., as shown by "One who has Fired," in the following experiments, or, according to Mr. Greener's experiments, more than twelve per cent. The only drawback that I know is that the loaded cases are more easily damaged, the edges of the brass being liable to injury from pressure; but, even if bent inwards, they are easily put right between the finger and thumb. Still I should advise the use of a cartridge belt instead of a pouch; and when placed in one of these they are quite safe.

As now manufactured, they are somewhat weak in the base, which sometimes gives way to the blow of the striker, and either from that cause or from some defect in the cap, a miss-fire occurs more frequently than in paper cases. Messrs. Kynoch have had their attention drawn to this defect, and have promised to remedy it in future, which promise, as they have a rival in their production in the National Arms Company, is likely to be carried out.

The series of experiments published by "One who has Fired" in the *Field* of July 1, 1882, was the first to bring to

the notice of the public the improvement effected by the "Perfect" cases, both with black and Schultze powder, when used in guns specially bored for them, that is to say, with No. 12 cases in a 10-bore gun, the No. 14 in a 12-bore, the No. 20 in a 16-bore, and the No. 24 in a 20-bore. Since that time his report has been more than confirmed by others, as well as by myself, and I shall therefore re-publish the whole series, and compare them with the best records of 1879, in the three classes, their figures of merit being calculated in the same way.

I may remark that all "the shells were loaded with a thin brown, glazed, grease-proof wad, a pink edge, a thick felt and a white card over the powder, and a thin white card over the shot;" but I regret that the exact diameter of the wads used was not ascertained, either in decimal parts of an inch or in the recognised gauges.

(1) 10-BORE GUN, weight 7lb. 11oz.; chambered for 12 "Perfect" shells; length, 31in.; load, 3drs. T. S. No. 4, and 1¼oz. No. 6 hard shot.

RIGHT.

| On 10in. Plate. | Force. | Total Pattern. | Observations. |
|---|---|---|---|
| 65 | 2·43 | 239 | Very good indeed. |
| 37 | 2·16 | 210 | |
| 31 | 2·10 | 196 | |
| 54 | 2·23 | 231 | |
| 56 | 2·29 | 231 | |
| 33 | 2·00 | 213 | Good. |
| 53 | 2·42 | 206 | Even. |
| 53 | 2·34 | 221 | |
| 46 | 2·13 | 207 | |
| 63 | 2·24 | 244 | Very good; a splendid shot. |
| 52 | 2·16 | 229 | Very even. |
| 45 | 2·11 | 187 | Thin, but a beautiful pattern; held to left. |
| 40 | 2·35 | 199 | |
| 48 | 2·23 | 216 | Average. |
| 65 | 2·43 | 244 | Highest. |
| 31 | 2·00 | 187 | Lowest. |

Figure of merit—439.

LEFT.

| On 10in. Plate. | Force. | Total Pattern. | Observations. |
|---|---|---|---|
| 45 | 2·11 | 237 | Too thick in middle. |
| 59 | 2·17 | 250 | Very even; grand shot. |
| 63 | 2·16 | 245 | Wonderfully even. |
| 46 | 2·23 | 204 | Grand shot; every pellet single. |
| 53 | 2·14 | 246 | Even and excellent |
| 42 | 2·10 | 234 | Very good. |
| 50 | 1·94 | 240 | Slightly patchy. |
| 41 | 1·93 | 233 | Very good. |
| 64 | 2·21 | 225 | |
| 57 | 2·10 | 231 | Very good. |
| 50 | 2·36 | 215 | |
| 58 | 2·36 | 238 | Very good. |
| 52 | 2·16 | 233 | Average. |
| 64 | 2·36 | 250 | Highest. |
| 41 | 1·93 | 204 | Lowest. |

Figure of merit—449.

SAME GUN; load, 42grs. Schultze, and 1¼oz. No. 6 hard shot.

| Right. | | | | Left. | | | |
|---|---|---|---|---|---|---|---|
| On 10in. Plate. | Force. | Total Pattern. | Observations. | On 10in. Plate. | Force. | Total Pattern. | Observations. |
| 42 | 2·98 | 252 | Could not be better. | 39 | 2·41 | 245 | Very good, but little high. |
| 47 | 2·40 | 257 | " " | 34 | 2·06 | 257 | Very good, but held to left. |
| 43 | 2·12 | 225 | " " | | | | |
| 48 | 2·15 | 236 | | 53 | 2·55 | 268 | Grand. |
| 58 | 2·45 | 246 | Not so even. | 32 | 2·81 | 244 | Very good. |
| 50 | 2·40 | 225 | | 68 | 2·50 | 254 | Ditto ditto. |
| 50 | 2·30 | 256 | | 59 | 2·56 | 259 | A beauty. |
| 40 | 2·17 | 251 | Held low. | 55 | 2·64 | 259 | Splendid. |
| 45 | 2·44 | 259 | | 50 | 2·40 | 260 | |
| 35 | 1·86 | 234 | Held considerably to left. | 50 | 2·78 | 255 | Little high. |
| | | | | 50 | 2·52 | 269 | |
| 43 | 2·49 | 253 | | 55 | 2·55 | 254 | Very good. |
| 55 | 2·45 | 262 | | 56 | 2·61 | 240 | |
| 45 | 2·56 | 275 | Beautiful pattern. | | | | |
| 46 | 2·37 | 249 | Average. | 50 | 2·55 | 255 | Average. |
| 58 | 2·98 | 275 | Highest. | 68 | 2·81 | 269 | Highest. |
| 35 | 1·86 | 225 | Lowest. | 32 | 2·06 | 240 | Lowest. |

Figure of merit—486. Figure of merit—510.

As no 10-bore gun was tested either in the 1878 or 1879 trials, the only reliable comparison that can be made is with Mr. Greener's two 10-bores of 1875, which made the following scores:—

| | Pattern. | | | Penetration of pad, multiplied by 6. | | |
|---|---|---|---|---|---|---|
| Greener, W. W.—10- | 268 | 276 | ............ | 234 | 210 | |
| gauge; 9lb. 10oz.; | 197 | 270 | ............ | 216 | 198 | |
| 31in. laminated steel; | 163 | 263 | ............ | 186 | 192 | |
| 1½oz. chilled shot; | 232 | 142 | ............ | 210 | 72 | |
| 4dr. Pigou No. 4 | 237 | 135 | ............ | 186 | 132 | |
| powder. | 247 | 236 | ............ | 168 | 186 | Figure of merit. |
| Averages ... | 222·1 | | | 182·5 | | ... 404·6 |
| Greener, W. W.—10- | 175 | 114 | ............ | 168 | 174 | |
| gauge; 9lb. 9oz.; | 252 | 189 | ............ | 180 | 132 | |
| 32in. Damascus; | 253 | 202 | ............ | 210 | 150 | |
| 1½oz. chilled shot; | 251 | 173 | ............ | 204 | 138 | |
| 4dr. Pigou No. 4 | 255 | 197 | ............ | 204 | 144 | |
| powder. | 245 | 255 | ............ | 210 | 198 | Figure of merit. |
| Averages ... | 213·4 | | | 176 | | ... 389·4 |

(2) 12-BORE GUN, weight 7lb. 9oz.; chambered for 14 "Perfect" shells; length, 30in.; load, 3drs. T. S. No. 4, and 1⅛oz. No. 6 hard shot.

| Right. | | | | Left. | | | |
|---|---|---|---|---|---|---|---|
| On 10in. Plate. | Force. | Total Pattern. | Observations. | On 10in. Plate. | Force. | Total Pattern. | Observations. |
| 42 | 2·62 | 225 | | 55 | 2·35 | 233 | |
| 32 | 2·19 | 207 | | 41 | 2·46 | 220 | |
| 50 | 2·38 | 219 | | 64 | 2·24 | 237 | |
| 48 | 2·29 | 242 | | 54 | 2·41 | 216 | |
| 34 | 1·88 | 141 | | 53 | 2·45 | 240 | |
| 45 | 2·51 | 219 | | 44 | 2·09 | 206 | |
| 51 | 2·35 | 236 | | 58 | 2·33 | 219 | Wonderfully even. |
| 48 | 2·50 | 216 | | 40 | 2·50 | 216 | |
| 56 | 2·32 | 195 | | 58 | 2·50 | 225 | |
| 52 | 2·50 | 235 | | 49 | 2·14 | 214 | |
| 48 | 2·50 | 215 | | 55 | 2·60 | 224 | Slightly patchy. |
| 40 | 2·50 | 236 | | 47 | 2·19 | 203 | |
| 54 | 2·32 | 230 | | | | | |
| 46 | 2·37 | 217 | Average. | 52 | 2·36 | 221 | Average. |
| 56 | 2·62 | 242 | Highest. | 64 | 2·60 | 240 | Highest. |
| 32 | 1·88 | 141 | Lowest. | 40 | 2·09 | 203 | Lowest. |

Figure of merit—454. Figure of merit—457.

SAME GUN; load, 42grs. Schultze, and 1⅛oz. of No. 6 hard shot.

| Right. | | | | Left. | | | |
|---|---|---|---|---|---|---|---|
| On 10in. Plate. | Force. | Total Pattern. | Observations. | On 10in. Plate. | Force. | Total Pattern. | Observations. |
| 42 | 2·26 | 230 | | 35 | 2·17 | 231 | |
| 46 | 2·35 | 218 | | 38 | 2·37 | 259 | |
| 49 | 2·53 | 240 | | 47 | 2·26 | 247 | |
| 69 | 3·04 | 238 | | 54 | 2·65 | 238 | |
| 56 | 2·54 | 272 | | 33 | 2·76 | 250 | |
| 55 | 2·47 | 252 | | 58 | 2·40 | 256 | |
| 47 | 1·98 | 242 | | 34 | 2·97 | 218 | |
| 49 | 2·69 | 246 | | 45 | 3·13 | 245 | |
| 55 | 2·87 | 248 | | 38 | 2·37 | 248 | |
| 49 | 2·24 | 261 | | 62 | 2·48 | 238 | |
| 38 | 3·45 | 238 | | 29 | 2·07 | 196 | Patchy, held to left. |
| 32 | 2·87 | 164 | | 43 | 2·44 | 227 | |
| 35 | 2·06 | 211 | | | | | |
| 48 | 2·57 | 235 | Average. | 43 | 2·51 | 238 | Average. |
| 69 | 3·45 | 272 | Highest. | 62 | 3·13 | 259 | Highest. |
| 32 | 1·98 | 164 | Lowest. | 29 | 2·07 | 196 | Lowest. |

Figure of merit—492. Figure of merit—489.

(3) **16-BORE GUN, weight, 6lb.; chambered for 20 "Perfect" shells; length, 30in.; load, 2¾drs. T. S. No. 4, and 1oz. No. 6 hard shot.**

| Right. | | | | Left. | | | |
|---|---|---|---|---|---|---|---|
| On 10in. Plate. | Force. | Total Pattern. | Observations. | On 10in. Plate. | Force. | Total Pattern. | Observations. |
| 38 | 1·84 | 204 | | 32 | 2·03 | 207 | |
| 48 | 1·96 | 194 | | 48 | 2·19 | 192 | |
| 33 | 2·12 | 204 | | 44 | 1·93 | 191 | |
| 38 | 2·13 | 200 | | 35 | 2·03 | 191 | |
| 47 | 2·51 | 196 | | 20 | 2·40 | 192 | |
| 37 | 2·16 | 205 | | 39 | 2·08 | 210 | |
| 35 | 2·00 | 181 | | 34 | 2·06 | 184 | |
| 39 | 2·05 | 208 | | 40 | 2·12 | 189 | |
| 26 | 1·69 | 181 | | 57 | 2·19 | 204 | |
| 35 | 2·09 | 191 | | 47 | 2·07 | 206 | |
| 59 | 2·25 | 178 | | 49 | 2·08 | 213 | |
| 46 | 2·28 | 203 | | 34 | 1·71 | 196 | |
| 48 | 2·15 | 196 | | | | | |
| 41 | 2·09 | 195 | Average. | 40 | 2·07 | 198 | Average. |
| 59 | 2·51 | 208 | Highest. | 57 | 2·40 | 213 | Highest. |
| 26 | 1·69 | 178 | Lowest. | 20 | 171 | 184 | Lowest. |
| Figure of merit—404. | | | | Figure of merit—405. | | | |

**SAME GUN; weight, 6lb.; load, 37½grs. Schultze, and 1oz. No. 6 hard shot.**

| Right. | | | | Left. | | | |
|---|---|---|---|---|---|---|---|
| On 10in. Plate. | Force. | Total Pattern. | Observations. | On 10in. Plate. | Force. | Total Pattern. | Observations. |
| 36 | 2·25 | 219 | | 50 | 2·54 | 202 | |
| 31 | 2·13 | 166 | | 17 | 2·65 | 158 | |
| 35 | 2·34 | 204 | | 45 | 2·67 | 214 | |
| 29 | 2·28 | 205 | | 31 | 2·03 | 207 | |
| 16 | 2·50 | 196 | | 34 | 2·41 | 208 | |
| 38 | 2·18 | 202 | | 23 | 2·30 | 193 | |
| 50 | 2·02 | 204 | | 29 | 2·00 | 186 | |
| 20 | 2·00 | 176 | | 49 | 2·20 | 197 | |
| 30 | 2·20 | 181 | | 30 | 2·17 | 201 | |
| 42 | 2·24 | 199 | | 44 | 2·18 | 179 | |
| 22 | 2·14 | 159 | Wild. | 51 | 2·33 | 226 | |
| 33 | 2·52 | 193 | | 31 | 1·94 | 192 | |
| 35 | 2·23 | 210 | | | | | |
| 32 | 2·23 | 193 | Average. | 36 | 2·29 | 197 | Average. |
| 50 | 2·52 | 219 | Highest. | 51 | 2·67 | 226 | Highest. |
| 16 | 2·00 | 159 | Lowest. | 17 | 1·94 | 158 | Lowest. |
| Figure of merit—416. | | | | Figure of merit—426. | | | |

(4) 20-BORE GUN, weight, 5lb. 6oz.; chambered for 24 "Perfect" shells; length, 28½in.; load, 2¼drs. T. S. No. 4, and 1oz. No. 6 hard shot.

| Right. | | | | Left. | | | |
|---|---|---|---|---|---|---|---|
| On 10in. Plate. | Force. | Total Pattern. | Observations. | On 10in. Plate. | Force. | Total Pattern. | Observations. |
| 44 | 2·09 | 196 | | 36 | 1·88 | 170 | |
| 36 | 1.86 | 188 | | 21 | 1·81 | 208 | Held to left very much. |
| 50 | 2·10 | 187 | | | | | |
| 50 | 1·96 | 189 | | 12 | 1·92 | 183 | Ditto, ditto. |
| 47 | 2·00 | 207 | | 38 | 1·76 | 186 | |
| 30 | 1·77 | 187 | | 49 | 1·90 | 174 | |
| 36 | 1·94 | 193 | | 42 | 1·95 | 204 | |
| 32 | 1·97 | 186 | | 32 | 1·69 | 189 | |
| 45 | 1·89 | 192 | | 21 | 1·67 | 160 | Thin, but a killing shot. |
| 46 | 1·96 | 183 | | | | | |
| 31 | 1·87 | 182 | | 50 | 1·74 | 209 | To left and high |
| 20 | 1·75 | 183 | | 19 | 2·00 | 155 | |
| 46 | 1·96 | 185 | | 34 | 2·00 | 167 | |
| | | | | 19 | 1·84 | 213 | |
| 39 | 1·93 | 189 | Average. | 31 | 1·84 | 185 | Average |
| 50 | 2·10 | 207 | Highest. | 50 | 2·00 | 213 | Highest. |
| 20 | 1·75 | 182 | Lowest. | 12 | 1·67 | 155 | Lowest. |
| Figure of merit—382. | | | | Figure of merit—369. | | | |

SAME GUN; load, 31grs. Schultze, and 1oz. No. 6 shot.

| Right. | | | | Left. | | | |
|---|---|---|---|---|---|---|---|
| On 10in. Plate. | Force. | Total Pattern. | Observations. | On 10in. Plate. | Force. | Total Pattern. | Observations. |
| 28 | 1·96 | 162 | | 36 | 1·81 | 192 | |
| 27 | 1·67 | 176 | | 34 | 1·91 | 194 | |
| 38 | 1·89 | 194 | | 23 | 1·83 | 180 | Patchy. |
| 51 | 1·96 | 188 | | 41 | 2·02 | 192 | |
| 32 | 1·91 | 187 | | 40 | 1·95 | 200 | |
| 43 | 2·02 | 204 | | 28 | 1·89 | 195 | |
| 33 | 2·03 | 183 | | 35 | 2·00 | 178 | |
| 27 | 2·11 | 187 | | 22 | 1·68 | 170 | Patchy. |
| 45 | 1·84 | 205 | | 29 | 1·83 | 187 | |
| 26 | 2·00 | 199 | | 37 | 2·03 | 194 | |
| 20 | 1·80 | 182 | Held low. | 36 | 2·11 | 199 | |
| 43 | 1·98 | 184 | | 37 | 1·97 | 197 | |
| 38 | 1·71 | 179 | | | | | |
| 35 | 1·91 | 187 | Average. | 33 | 1·92 | 190 | Average. |
| 51 | 2·11 | 205 | Highest. | 41 | 2·11 | 200 | Highest. |
| 20 | 1·67 | 162 | Lowest. | 22 | 1·68 | 170 | Lowest. |
| Figure of merit—378. | | | | Figure of merit—382. | | | |

On comparing these records with those of the 1875, 1878, and 1879 trials, it will be seen that, except in pattern, no great improvement was shown as effected by the Kynoch shells, and we all know that since those dates gunmakers have greatly improved in this respect. "One who has Fired" was, however, so enthusiastic in his admiration of the regularity of the spread and uniformity in numbers of the pattern, that I could not but believe there was a great improvement effected in reality, though not easily to be demonstrated without an inspection. Nevertheless, it was not till his opinions were supported by the series of trials made by Mr. Greener and Mr. Jones, and also by minor ones under my own observation, that I was thoroughly convinced.

With regard to the comparison of the 10-bores with those shot in 1875, it will be seen that in both those shot in 1875 1⅜oz. of shot was used instead of 1⅛oz. in the Kynoch trial, and yet the average pattern of the latter (25 shots against 24) was 224·50 against 217·2. I may mention that the 1875 guns were full choked. Here, then, we find a 10-bore gun of 7lb. 11oz. shot with 1dr. less powder and ⅜dr. (100 pellets) less shot, beating two guns averaging 9lb. 9½oz.—certainly a most extraordinary performance. In one instance 275 pellets out of 306 were put into the 30in. circle, being proportionally equal to the 298 in a 40in. square recorded hereafter, *with a beautifully regular pattern.*

In reference to the 12-bore Kynoch gun, the comparison is simple enough with the best 12-bore of 1879 computed in the same way, both being shot with black powder, and the only difference being in the weights, the 1879 gun being 6lb. 14oz. against the Kynoch gun of 7lb. 9oz.

| | Pattern. | Force. | Figure of Merit. |
|---|---|---|---|
| 1879 best 12-bore ...... | 209·60 ......... | 238·72 ......... | 448·32 |
| Kynoch gun ............. | 219·00 ......... | 236·50 ......... | 455·50 |

It will be observed that this Kynoch gun in one instance

put 272 pellets in the 30in. circle, being within three pellets of the 10-bore Kynoch gun.

Now let us compare the 16-bore Kynoch with the best of the 16-bores in 1879, which used 1oz. of shot. As the winner only used ⅞oz., that gun is not suitable for comparison.

| | Pattern. | Force. | Figure of Merit. |
|---|---|---|---|
| 1879 best 16-bore ...... | 189·96 ......... | 226·40 ......... | 416·36 |
| Kynoch gun ............... | 196·50 ......... | 208·00 ......... | 404·50 |

In this case the result is in favour of the 1879 gun, but still the pattern of the Kynoch is higher by 6·54, and its figure of merit beats the average figure of the 16-bores of 1879 by 404·50 as compared with 378·52.

Lastly, in examining the 20-bore recently shot with the best of those shot at the 1879 trial, we find the result is slightly in favour of the Kynoch gun as regards pattern, but the reverse as regards force:

| | Pattern. | Force. | Figure of merit. |
|---|---|---|---|
| 1879 best 20-bore ...... | 183·80 ......... | 204·92 ......... | 388·70 |
| Kynoch 20-bore ......... | 187·00 ......... | 188·50 ......... | 375·50 |

Nevertheless if we again compare it with the average of the twelve guns of 1879, which was average pattern 147·09, average penetration 210·97 = figure of merit 358·06, the superiority of the Kynoch is manifested. The superiority in pattern is very decided, whilst the difference in penetration is comparatively small, and is probably due to the use of a swedge instead of a crimper, the former, according to my judgment, giving more work for the powder to expand it than the latter.

In the whole of the above trials with the Kynoch cases, the guns used were bored by Mr. Ford, so that it is possible that the inferiority in the results obtained as compared with those recorded in the trial with the guns made by Mr. Greener and Mr. Jones, may be due to this cause.

In the *Field* of the same date (July 1, 1882), Mr. Greener reports a trial between the paper case in one of Dr. Carver's

guns, and the "Perfect" case in a pigeon gun expressly made for it, in which the force from the use of the latter is largely increased. Here, however, comparison is not so feasible as would appear upon the surface, for although the charge of powder and shot was the same with both guns, and both are *nominally* 12-bores, they are not of the same calibre, a gun bored for No. 12 "Perfect" cases is actually of 10-gauge, as is fully demonstrated in the section on the conversion of chambers to take the brass case, page 286. With this explanation, to prevent any mistake, I append Mr. Greener's letter:

SIR,—I beg to hand you record of shooting of a 12-bore pigeon gun, bored for Kynoch's "Perfect" cases, shot at St. Mary's Works. The penetration was taken by the *Field* force-gauge, in the presence of Mr. Jones. For comparison we tried one of Dr. Carver's guns, bored for the 3in. paper case, and annex the result. The charge used in both trials was 4drs. black powder and $1\frac{1}{4}$oz. No. 6 shot, 270 to the ounce.

"PERFECT" CASE—40yds.

| Index. | 10in. | Force. | Pattern. |
|---|---|---|---|
| 192 | 73 | 2·63 | 270 |
| 174 | 64 | 2·71 | 285 |
| 213 | 80 | 2·66 | 304 |
| 192 | 73 | 2·63 | 294 |
| 170 | 65 | 2·61 | 278 |
| 167 | 61 | 2·73 | 263 |
| | Total | 15·97 | 1694 |
| | Average | 2·66 | 282·33 |

Figure of merit—548·33.

PAPER CASE—40yds.

| Index. | 10in. | Force. | Pattern. |
|---|---|---|---|
| 147 | 59 | 2·49 | 253 |
| 113 | 48 | 2·35 | 244 |
| 119 | 54 | 2·21 | 232 |
| 175 | 68 | 2·57 | 270 |
| 128 | 54 | 2·37 | 232 |
| 67 | 32 | 2·07 | 197 |
| | Total | 14·08 | 1428 |
| | Average | 2·34 | 238 |

Figure of merit—472.

"PERFECT" CASE—45yds.

| Index. | 10in. | Force. | Pattern. |
|---|---|---|---|
| 154 | 69 | 2·23 | 252 |
| 128 | 53 | 2·42 | 241 |
| 100 | 46 | 2·17 | 238 |
| | Total | 6·82 | 731 |
| | Average | 2·27 | 243·66 |

Figure of merit—470·66.

PAPER CASE—45yds.

| Index. | 10in. | Force. | Pattern. |
|---|---|---|---|
| 92 | 46 | 2·00 | 194 |
| 94 | 47 | 2·00 | 201 |
| 68 | 48 | 1·79 | 198 |
| | Total | 5·79 | 586 |
| | Average | 1·93 | 195·33 |

Figure of merit—388·33.

We are continuing our experiments with larger shot and other guns, and shall be pleased to give the results next week, by your kind permission. W. W. GREENER.

Birmingham, June 28, 1882.

Here it appears that the "Perfect" case beat the paper case in force by 2·66 to 2·34, and in pattern by 282 to 238; but, as already intimated, it was 10-bore against 12-bore, with equal charges.

In the following week another trial by Mr. Greener was recorded, which I also insert in full; but here again the gun alluded to by Mr. Greener as a 12-bore is one bored for No. 12 "Perfect" cases, and consequently is of 10-gauge. It, cannot, therefore, be put into strict comparison with the 12-bores of 1879, as it would have been excluded from that competition, not only from its bore, but also by its weight, as the guns were limited to 7¼lb., whereas this gun was subsequently (Aug. 26) stated by Mr. Greener to be over 8lb. in weight.

Sir,—Referring to last week's letter, I wish to call attention to the record I gave with 1⅛oz., being so much better than the best at the 1879 trial, both as to penetration and pattern; but the gun used being bored for 1¼oz. does better with that charge, as will be seen by comparing the last two weeks' trials. We get 52 more pattern with the extra ⅛oz. of shot, although there are only 35 pellets in the ⅛oz.; the penetration with 1¼oz. is also considerably better in proportion to the 1⅛oz. We have fired at different times upwards of 80 shots with this gun, and do not find any wild shots, the average being 280.

The shooting of the 14 case proved very uniform, as recorded below, and I may say that the records of all the brass cases are considerably more uniform than the paper, when the guns are bored especially for them. Being anxious to try the above 12-bore gun with large shot, I found the machine would not register it at 40 yards, so went back to 45 yards, and got an average pattern of 209 with 1¼oz. No. 5 (220 to the ounce); with the paper case at 40 yards it was only 187. The force with brass case at 45 yards was 2·97; with paper case at 40 yards it was 2·93; the charge of powder was 4drs. black, and the gun we shot the paper cases from was Dr. Carver's, the same as used with No. 6 shot previously recorded. The record with brass cases with Nos. 4 and 3 shot was still more surprising; the average force with No. 4 shot, 45 yards, was 3·89, and with No. 3, 45 yards, 4·62.

I think the 12-bore gun will be found to be the best for all-round shooting, and may say that it beats any 10-bore with the paper case,

bored on the old system, that I have seen. The 14-bore was shot under very adverse circumstances on the 11th inst., as it poured with rain all the time, and we have obtained previously better patterns with the same gun. I beg to call attention to the fact that the 14-bore gives better penetration than the 12 National case with ½dr. less powder; and I may add that these cartridges were crimped throughout with our crimper, as advertised in the *Field*, and not the one recommended by "One who has Fired," for we have found the last-mentioned one, which compresses the metal into itself (whereas ours simply binds it in), hardens the metal, and it is liable to split when fired, and, in my opinion, it is far from being any improvement, but simply ruins the cases.

Birmingham, July 12, 1882. W. W. GREENER.

14-Bore "Perfect," 3¼drs. black powder, 1⅛oz. No. 6 shot.

| On 10in. Plate. | Force. | Total Pattern. | On 10in. Plate. | Force. | Total Pattern. | |
|---|---|---|---|---|---|---|
| 55 | 2·51 | 211 | 63 | 2·65 | 225 | |
| 55 | 2·55 | 205 | 53 | 2·55 | 211 | |
| 45 | 2·38 | 217 | — | — | — | |
| 39 | 2·20 | 204 | 52 | 2·45 | 214 | Average. |
| 46 | 2·28 | 216 | — | — | — | |
| 59 | 2·56 | 223 | 63 | 2·65 | 227 | Highest. |
| 56 | 2·55 | 209 | 39 | 2·20 | 204 | Lowest. |
| 51 | 2·35 | 227 | | Figure of merit—459. | | |

In this trial (which was a 12-bore gun chambered for the No. 14 "Perfect" case) the force recorded is 2·45, being somewhat higher than the highest 12-bore of 1879, which was that of Mr. Jeffries, viz., 2·38.

Again, in a trial of black powder against Schultze and E.C. powder, made at my request by Mr. Jones, and recorded in the *Field* of July 29th, 1882, the average force with a No. 14 "Perfect" case in a 12-bore gun, shot with 3drs. powder and 1⅛oz. chilled shot, was 2·34, and with 3¼drs. 2·41; but this will be better given at length in considering the relative value of the three powders at present in the market, viz., black, Schultze, and E. C. In the same number of the *Field* another trial is recorded by Mr. Greener as follows:—

SIR,—In continuance of our last we give below record of a 20-bore gun, bored for the "Perfect" cases, and find the pattern wonderfully regular—nothing approaching a wild shot in the

whole series—penetration being 2·25 against the 20-bore recorded by "One who has Fired," July 1, with same charge, 2·07. We also give the record of another 14-bore, shot on a fine day (as we said, July 15, the trial of the 14-bore was shot during a wet and stormy day); it will be seen the pattern is very much better, penetration not quite so good. W. W. Greener.

Birmingham, July 26.

"Perfect" Case, 20-bore, 2¾drs. black powder, and 1oz. No. 6.

| On 10in. Plate. | | Force. | | Total Pattern. | |
|---|---|---|---|---|---|
| 52 | ... | 2·27 | ... | 209 | |
| 35 | ... | 2·21 | ... | 192 | |
| 37 | ... | 2·27 | ... | 193 | |
| 41 | ... | 2·32 | ... | 188 | |
| 50 | ... | 2·32 | ... | 190 | |
| 51 | ... | 2·24 | ... | 191 | |
| 48 | ... | 2·25 | ... | 192 | |
| 47 | ... | 2·40 | ... | 193 | |
| 44 | ... | 2·21 | ... | 193 | |
| 33 | ... | 2·27 | ... | 184 | |
| 46 | ... | 2·15 | ... | 199 | |
| 45 | ... | 2·16 | ... | 198 | |
| 44 | ... | 2·25 | ... | 194 | Average. |
| 52 | ... | 2·40 | ... | 209 | Highest. |
| 33 | ... | 2·15 | ... | 184 | Lowest. |

Figure of Merit—419.

"Perfect," 14-bore, 3¼drs. black powder, and 1⅛oz. No. 6 shot.

| On 10in. Plate. | | Force. | | Total Pattern. | |
|---|---|---|---|---|---|
| 45 | ... | 2·29 | ... | 228 | |
| 57 | ... | 2·28 | ... | 235 | |
| 66 | ... | 2·53 | ... | 245 | |
| 64 | ... | 2·47 | ... | 239 | |
| 48 | ... | 2·40 | ... | 226 | |
| 57 | ... | 2·72 | ... | 228 | |
| 59 | ... | 2·51 | ... | 239 | |
| 42 | ... | 2·38 | ... | 219 | |
| 62 | ... | 2·50 | ... | 235 | |
| 63 | ... | 2·40 | ... | 239 | |
| 43 | ... | 2·32 | ... | 225 | |
| 49 | ... | 2·39 | ... | 225 | |
| 54 | ... | 2·43 | ... | 231 | Average. |
| 66 | ... | 2·53 | ... | 245 | Highest. |
| 42 | ... | 2·28 | ... | 219 | Lowest. |

Figure of Merit—474.

The former of these was of course a 16-bore gun with a No. 20 "Perfect" case, and the latter a 12-bore with a No. 14 "Perfect" case. On comparing the results with those recorded by "One who has Fired," we find that the figure of merit has improved in the 16-bore from 405 to 419, and in the 12-bore from 455 to 474, whilst the force in the latter has reached the high average of 2·43.

Mr. Greener's next letter related to the trial of the above-mentioned pigeon gun with two kinds of brass cases, and was as follows:

Sir,—Agreeably to your suggestion, I now beg to hand you a record of this week's shooting, carried out the same as 1879 trial, with 1⅛oz. shot, except that we have only used the left barrel of the same gun as was used last week. The whole of the shots are given just as they were taken, fifteen with Kynoch's cases, and fourteen

with National Arms cases. The National has a much larger cap than the Kynoch. I may here say the force gauge made by Mr. Jones worked exceedingly well throughout, and reflects great credit on the maker. I beg to say this gun, the record of which is given below, was built for a pigeon gun, and bored for 1¼oz. of shot; I hope, however, to give next week a record of one bored for 1⅛oz.

Birmingham, July 5, 1882. W. W. Greener.

Cartridge 12, National; 3¼drs. 5grs. black, 1⅛oz. No. 6, *Field* Trial size.

| On 10in. plate. | Force. | Total Pattern. | |
|---|---|---|---|
| 81 | 2·55 | 243 | |
| 40 | 2·25 | 239 | |
| 55 | 2·40 | 245 | |
| 45 | 2·28 | 238 | |
| 61 | 2·50 | 229 | |
| 46 | 2·34 | 222 | |
| 42 | 2·33 | 232 | |
| 45 | 2·31 | 213 | |
| 47 | 2·19 | 182 | |
| 75 | 2·64 | 240 | |
| 79 | 2·72 | 244 | |
| 62 | 2·48 | 233 | |
| 50 | 2·30 | 230 | |
| 47 | 2·31 | 235 | |
| 55·35 | 2·40 | 230 | Average. |
| 81 | 2·72 | 245 | Highest. |
| 40 | 2·19 | 182 | Lowest. |

Figure of merit—470.

Cartridge 12, Kynoch; 3¼drs. 5grs. black, 1⅛oz. No. 6, *Field* Trial size.

| On 10in. plate. | Force. | Total Pattern. | |
|---|---|---|---|
| 42 | 2·88 | 243 | |
| 54 | 2·62 | 245 | |
| 65 | 2·53 | 235 | |
| 69 | 2·66 | 251 | |
| 60 | 2·55 | 238 | |
| 73 | 2·49 | 236 | |
| 30 | 2·00 | 155 | |
| 52 | 2·46 | 236 | |
| 42 | 2·21 | 221 | |
| 63 | 2·69 | 239 | |
| 43 | 2·16 | 163 | |
| 55 | 2·36 | 213 | |
| 72 | 2·69 | 244 | |
| 57 | 2·54 | 207 | |
| 52 | 2·59 | 244 | |
| 55·26 | 2·49 | 224 | Average. |
| 73 | 2·88 | 251 | Highest. |
| 30 | 2·00 | 155 | Lowest. |

Figure of merit—473.

Comparing the above results with those obtained by "One who has Fired," it will be seen that both the National Arms and the Kynoch cases in Mr. Greener's gun have a considerable advantage, using similar charges of shot, although the gun was specially bored for 1¼oz. of shot. It will be seen that the charge of powder was also reduced, which will account for the "force" coming down from 2·66 to 2·40 with the National and 2·49 with the Kynoch; but with the latter one shot (the first, 2·88) exceeded the highest of the previous score by ·15.

After carefully investigating the experiments made by "One who has Fired," Mr. Greener, and Mr. Jones, and verifying them myself, I was satisfied that they had by no

means overstated the advantages of the "Perfect" case. According to my judgment, it is destined to effect almost as great an improvement as choke-boring, and in some respects even more; because it not only brings up twenty or thirty more pellets to the target aimed at, whether living or dead, but all those reaching it do so with nearly equal force, there being none of those weak ones which barely penetrate the paper pad when that is used, or strike the plate of the force-gauge in successive batches; the later ones producing little or no effect on it as compared with the first flight, and having a corresponding degree of weakness in penetrating the body of living game.

The above remarks were published by me in the *Field* of Sept. 9th, 1882, in anticipation of the present work, and led to the following interesting letter from the correspondent of the *Field* signing himself "T.," drawing attention to the necessity of, in future, distinguishing cartridge cases by their internal diameters. His reasons are very cogent, but I fear, at present, we must content ourselves with things as they are, leaving the change to be made, if ever, to the day when paper cases are things of the past.

SIR,—The introduction of cartridge-cases or "shells" made of thin brass, instead of thick paper, is leading to a great deal of confusion with regard to the nomenclature of guns that are bored to suit them. Trials said to have been carried out with 12-bores have in reality been made with guns of much larger calibre, and consequently the published results are misleading; and, although you have endeavoured to remove misapprehension by brief explanatory remarks, persons will perpetually be misled if the misrepresentation is allowed to continue; for while the evil is suffered to exist the misrepresentation is constantly being reiterated and the effect strengthened, whereas the words of caution or correction are soon lost sight of, and by many persons are never seen. Cannot something be done to stop the evil before it is too late?

It may seem absurdly needless to lay down the obvious principle that guns of the same bore are similar in calibre, or internal diameter, no matter how much they may differ in thickness of

metal or external dimensions. And one might suppose it equally unnecessary to state that the bore of the cartridge-case is likewise dependent on its calibre, irrespective of the thickness of the material from which it is made. Nevertheless, it is owing to a departure from this elementary principle that the confusion now arises.

So long as muzzle-loaders alone were in vogue, there could be no misapprehension on this point, because the 12-bore gun would take a spherical bullet of twelve to the pound, a 16-bore would take a 1oz. ball, and so on; and it would be useless to attempt to load a 12-bore gun with a bullet two sizes larger than the bore. When, by the introduction of breechloaders, loose powder and shot went out of fashion, the actual bore of the gun was supplemented by a breech-chamber made sufficiently large to admit of the full-sized charge and its envelope; in other words, the width of the chamber was equal to the width of the bore *plus* twice the thickness of the paper. Guns made by different makers might vary a little in their calibre, and also in the size of the chamber, and the paper used in the manufacture of the cartridges might differ a little in thickness; but, practically, in most cases, a 12-bore gun still represented a gun which would take a bullet of twelve to the pound, and such bullets could be, and occasionally are, substituted for small shot in 12-bore cylinder guns.

Now, however, come the "Perfect" cartridges made of metal that is only about a quarter as thick as the paper of the cartridges hitherto in use. Of course, with guns of equal bore, the chamber for thin brass cases need not be made so wide as was necessary to admit those of thick paper; and consequently the chamber of the new 12-bore will be smaller than that of the old, the calibre of the gun remaining the same size, The owner of a favourite 12-bore, hitherto used with paper "shells," may have the big chamber "bushed," and reduced to the size requisite for the "Perfect" cartridges of thin brass; the bore remains unchanged, and bullets of twelve to the pound may be used with it as heretofore. Is this gun now to be called a 14-bore?

Such appears to be the position to which we are drifting, unless a stop be made in time; and it is with the hope that you will use your influence to put an effective check on the practice now creeping in that I am induced to write this letter.

You have already pointed out that the so-called 12-bore "Perfect" cartridges are actually 10-bores. Guns specially bored

to suit these so-called 12-bore cartridges are much heavier than ordinary 12-bores, and are large enough in calibre to take a bullet of ten to the pound. The process of development which has led up to this state of things is as follows:—In the first place, thin metal cases of enlarged calibre are called 12-bore, because they fit into chambers made for 12-bore paper cases; secondly, new guns are made of larger calibre, as being better adapted for the new cartridges; and thirdly, the new guns, despite their larger calibre, are dubbed "12-bores," because the cartridges are so numbered. So the real bore is ignored, and the name is transferred to the external dimensions of the cartridge.

No doubt it may be said that these so-called 12-bore cartridges can be used instead of the ordinary paper cases in existing 12-bore guns. That is perfectly true; but they can equally well be used that way, whether they are called 12-bores or 10-bores; and it is better that they should bear their proper name. The possessors of 12-bore guns built for paper cases will be put to no inconvenience so long as they continue to use paper cases; and if they want to try brass instead of paper, without going to the expense of altering their guns, they can readily see that, as the calibre of the cartridge is greatly enlarged, the bore will be 10 instead of 12. In course of time (should paper cases die out) even this little inconvenience will cease. On the other hand, if all those persons who buy new guns, or alter their old ones, have to order so-called 14-bore cases to fit their 12-bore guns, the evil will become permanent, and an anomalous condition of things will be established, by which it will be made to appear that the chamber of the gun is smaller than the bore, instead of the reverse.

It is even possible that the putting of No. 12 on 10-bore cartridges may lead to accidents; for if any one happened inadvertently to put into the chamber of his old-fashioned 12-bore one of these cartridges loaded with a 10-bore bullet, the consequences of pulling the trigger might be rather unpleasant.

Be this as it may, however, it seems to me that we ought to call things by their right names; and cartridges should be numbered by their actual bore, and not by their outward dimensions. Some little inconvenience must always arise during a transition period; but when men have *bonâ fide* 12-bore guns properly constructed for the new cartridges, they should not be compelled to call them 14-bores, in order that other persons may use 10-bore cartridges in a makeshift sort of way and delusively consider them 12-bore.

T.

I have already stated my opinion of the superiority of the brass over the paper cases in every respect but security from missfires, which, being a mere matter of detail, they will no doubt soon be improved.

The National Arms Company, of Birmingham, who have for many years made a strong brass case, have lately produced a light one which, like Kynoch's, is of the same weight as the paper case. I have only tried a few of them, but as far as I have done so they have promised well. There is no joint at the base, as in Kynoch's case, and the cap anvil is of the ordinary description, so that "reloading" is much more difficult, as the exploded case must be driven out by a pointed tool, which soon enlarges the opening too much. The price is 48*s*. per 1000.

## SECTION III.

### Conversion of Gun Chambers to take the Brass Cases.

The sportsman having determined to use the brass cases, the next question to be decided is whether to have new barrels chambered to fit them, or to have the old barrels bushed and the chambers rebored, or to attempt to alter the old boring. One of the most common defects of modern guns is that the chambers do not fit the cases used with them. Unfortunately, cartridge-case makers do not all use the same gauges, the No. 12 case varying from ·791 inch in Kynoch's "Perfect" to ·797 inch in the old brass cases of the Birmingham N.A. Company, and ·793 in their new light ones. Eley's size varies from ·788 to ·796, and Joyce's from ·792 to ·796 inch. Now, the chamber ought not to be more than ·002, or at the most ·003 inch, larger than the case, so that it is impossible for any one chamber to suit all the above sizes. Either it is too tight, and the cases stick, or it is too loose and they burst. It so happens, however, that a No. 14 Kynoch's "Perfect" case suits a 12-bore gun nearly exactly, and if a

new gun is to be made it is easy enough to bore the chamber small enough to fit it, viz., ·760 inch instead of ·795 to ·798 for the No. 12 case.

To show the difference between a 12-bore case in a gun chambered for paper, and a No. 14 case in a 12-bore gun made on purpose for it, I append diagrams of the two of the exact sizes. It will be seen at once that in the former case


FIG. 2.


FIG. 3.

(Fig. 2) the internal diameter is ·777 inch or ·002 inch more than a 10-bore; while in the latter (Fig. 3) it is ·744, or only ·015 inch more than the 12-bore, and just the proper size to give good results. The same plan applies to the smaller bores. The No. 20 case will do for the 16-bore gun, and the No. 24 case for the 20-bore gun; but, to make this still clearer, I append a diagram of the several sizes, giving their diameters inside and outside their mouths and outside their bases, not including the rim, together with the several gauges for which they are best adapted. (See Fig. 4.)

If, therefore, a sportsman wants his gun altered, he must either have a pair of new barrels at a cost of 5*l.* or 6*l.* (average Birmingham price), or 10*l.* to 15*l.* (London prices); or he must have the old ones fiddled with, on the plan adopted

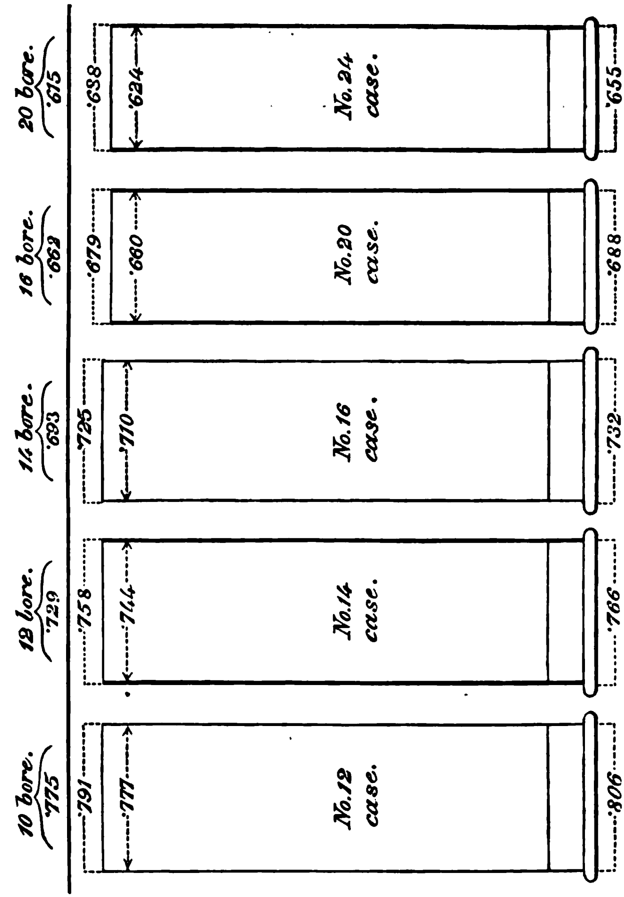



Fig. 4.—Sizes of Kynoch's "Perfect" Cases as measured by the Author.

by Mr. Ford, for "One Who Has Fired," and others who have trusted him, but which, I confess, I do not like; or he must have the chambers bushed with steel and rebored—which was first done by an amateur mechanic with great success, in the gun to which I shall presently allude as making the extraordinary

pattern mentioned. This was at my suggestion on a plan proposed to me by Mr. Jones, of Birmingham, who has since then himself carried it out in a most satisfactory manner. The plan adopted is as follows: He first turned his cutter exactly of the size of the "Perfect" No. 14 case, but with a guide fitting the bore of the barrel. He then turned another a quarter of an inch longer, and with a similar guide, but with a diameter for half an inch of ·822, so as to cut out to the depth of the rim of the case, from which it tapered to about ·790 inch. Both of these were then converted into cutters in the usual way. With the larger one he enlarged the original chambers, cutting out down to the end of the cone. He then tapped the enlarged portion with a very fine thread, when the barrels were ready for fitting in the bush, for which he used a piece of steel tubing about an eighth of an inch thick. Putting this on the lathe, he turned down the part beyond the enlarged half-inch to fit the conical part of the altered chamber, and with his screw tool cut the corresponding thread on the enlargement, having previously turned it to the proper size. He then screwed it in till the end came well up to the shoulder left at the end of the cone, after which he put in his smaller cutter and finished out the chamber; but, as is generally the case with a first experiment, he did not get exactly the size he wanted, the chamber being left ·002 inch too large, though this does not seem to affect the shooting or to injure the cases. Finally, he had to cut out the space for the extractor, and his task was completed.

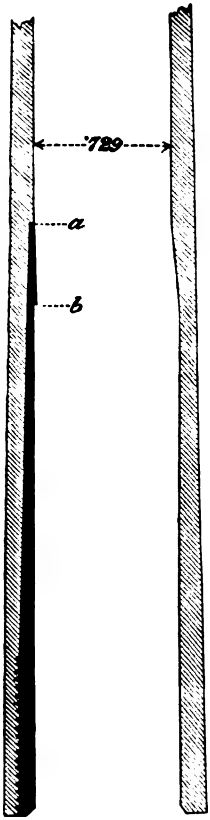
## SECTION IV.

### Reboring.

The question whether the above process by bushing the chambers is safe or not having been raised in the *Field* by "One Who Has Fired" and by Mr. Greener, I inserted the

following remarks on this important subject in that journal, proving its safety, in my opinion, beyond dispute:

Mr. Greener having given an opinion in the *Field* of the 16th inst., that the advisability of bushing the chamber for the purpose of altering a gun to take the "Perfect" case is doubtful, we have gone into the question with some care, out of deference to his admittedly high authority. After drawing attention to his statement at page 455 of "The Gun and its Development"—that the weakest part of a gun barrel is at the bottom of the chamber—Mr. Greener, in his letter of the above date adds: "When the chamber is deepened to remove the cone previous to bushing, it is obvious that the taper barrel must be further weakened at that, its weakest point, while the bush itself does not materially strengthen the barrel, if at all."




On referring to that page, we find he also gives the result of an experiment, in which he "made a longitudinal incision in a barrel extending half the length of the cartridge chamber, and a transverse slit severing one-third of the circumference, the two incisions forming a T on one side of the cartridge chamber." As a result, he says: "With ordinary charges these slits were not appreciably opened, but with 50grs. Schultze and $1\frac{1}{8}$oz. of shot the longitudinal slit widened ·08in., the transverse ·045in.

Now, in the bushing process, it is true that the end of the cone, where it merges in the bore, at *a* (see engraving), is cut out about ·010 inch on each side; but the weakest part (namely, at *b*) is scarcely touched at all. On the right side of the accompanying section we have had the chamber drawn as it was before the bushing; while on the left it is shown with the bush inserted, as indicated by a full black colour. Now, on comparing the two, it will be seen that the part *a* in the bushed chamber is not so weak as the part *b* was before bushing, while the part *b* is strengthened

considerably by the insertion of the steel cylinder, acting like the steel lining of a "big gun." This will perhaps be rendered more intelligible if the exact measurements are given, which we will therefore do."

The diameter of the chamber at *b* varies in 12-bore guns from ·810in. to ·798in.; and the external diameter of the No. 14 "Perfect" case is ·758. Consequently, it is only necessary, on the first enlargement of the chamber, to allow space at *b* for a thickness of bushing sufficiently strong to prevent the metal of the bush breaking at that part when the final boring-out for the cartridge is done. This may be put at ·015in., or calculating both sides, ·030in., making the diameter at that part ·758 + ·030 + ·003in. = ·791in., which is ·007in. less than the smallest chamber mentioned above. Practically, however, in order to make a clean cut, it should be taken out to about ·800in., which will remove only ·002 in a small chamber (·798in.), and in a large one (·810in.) would remove nothing whatever, and would even require a bush of extra thickness in order to fill up the old chamber.

The more we examine into this bushing process, as carried out by Mr. Jones, the more we are satisfied that it not only does not weaken the gun to which it is applied, but actually strengthens its weakest part. Mr. Greener has shown, by the experiment above referred to, that the barrel is stronger longitudinally than transversely in the proportion of 9 to 1 (·45 to ·05); so that, even if in the former direction the barrel is weakened (which we have shown that it is not), its reduction in strength would be more than counterbalanced by the increase in that respect afforded to the weakest point, viz., the widest part of the chamber cone at *b*. In addition to Mr. Jones's barrels, we have also received, for our report, a pair bushed by Messrs. Bland and Sons in a similar manner. We have pleasure in stating that the work is done to our entire satisfaction.

Mr. Jeffries has also sent us for examination a gun which he has bushed with removable cylinders, so that either paper or brass cases may be used, the former without and the latter with the cylinders inserted. But even with his plan a new extractor must be added as he has done, and this must be exchanged for the old one before the sportsman can resort to the paper cases. In our opinion, this plan is very inferior to that adopted by Mr. Jones.

With regard to Mr. Ford's reboring, I am quite satisfied that it is of a highly dangerous nature, the barrels being

enlarged at half an inch beyond the cone from ·719in. to ·746in. diameter; that is to say, about twice the thickness of the brass case on each side, and at their weakest part. It must be remembered that while the bore remains almost, though not quite a true cylinder from the end of the chamber cone, for at least a foot the outside of the barrels tapers rapidly, and consequently the metal becomes, *pari passu*, reduced in thickness. Now, I am quite of opinion that if the cone was only lengthened from ⅝in. to one inch no great risk would be run, because the amount of tapering in that length is not very great. But when I find, as I have done, on measuring Mr. Ford's altered barrels, that he runs his taper for several inches into the barrels, and in so doing cuts away ·013in at half an inch from the cone, and ·006in. at two inches from that point, I am compelled to think that the process is not only contrary to the Gun Proof Act, but of a highly dangerous character. In this opinion I am supported by several gunmakers of high authority, among those whom I have consulted, and not one has supported Mr. Ford in the slightest possible degree. I shall therefore dismiss his plan from my own mind altogether, leaving for my readers' consideration the choice between new barrels and rebushing.

But while the question is thus settled in my judgment, it is fair to Mr. Ford to state that the correspondent signing himself "One Who Has Fired," in the *Field*, upholds his plan of reboring, both in point of safety and efficiency, and that he is a gentleman of great experience and knowledge of guns. Moreover, several gentlemen for whom Mr. Ford has rebored guns have written to that paper in terms of high approbation. My readers must therefore judge for themselves in this disputed point.

# CHAPTER X.

## EXPLOSIVES USED IN SHOT GUNS.

### SECTION I.

#### General Remarks.

Until the invention of the detonating gun only one kind of explosive was used in shot guns and rifles, viz., black powder, and that of nearly exactly the same composition as is used in the present day. In the 1878 *Field* gun trial Mr. Pigou, of the firm of Pigou, Wilks, and Laurence, produced a canister of their powder made in 1790, which I tried in public, and found it equal in strength to any at present in use, though too fine for breechloaders, but still showing that no great improvement had been made in the manufacture during the last century. When the detonator was invented the ignition by flint and steel was of course abandoned, and then a second explosive was required, which was, and still is, chiefly composed of fulminate of mercury, as I shall presently describe. These two explosives satisfied the wants of sportsmen until about twenty years ago, when several attempts were made to substitute a comparatively smokeless compound for the black powder, which produces a considerable amount of smoke, obscuring for some seconds after ignition the view of the object shot. That first used was gun cotton, but this was ultimately rejected as unsafe, and also weak in its driving force. About fifteen years ago, however, wood powder, made under the patent of a German military officer (Capt. Schultze),

was introduced ; and, with certain improvements on his process made by a company under the title of the Schultze Powder Company, is now extensively used. Gun felt, a modification of gun cotton, has also been tried without success; and in America a modification of the Schultze powder, made by a Mr. Dittmar, is generally adopted. Lastly, in the present year the Explosives Company, who had previously chiefly manufactured guncotton and dynamite for mining and military purposes, have brought out a new gunpowder, which is a modification of gun cotton, and named by them E. C. powder, and which promises to be a formidable rival both of the black and Schultze powders. The above may be said to comprise the list of explosives at present used by sportsmen in this country.

## SECTION II.

### Black Gunpowder.

This explosive, whether made in England, America, France, Belgium, or in any other country of Europe, is invariably composed of the same three materials, viz., nitre, charcoal, and sulphur, but the proportion of the three varies slightly, as will be seen from the following table, published by Capt. Jervis-White Jervis, to which I have added the powders of America and Switzerland :—

| | Nitre. | Charcoal. | Sulphur. |
|---|---|---|---|
| England | 75·00 | 15·00 | 10·00 |
| France | 75·00 | 12·50 | 12·50 |
| Austria | 75·00 | 15·00 | 10·00 |
| Prussia | 75·00 | 13·50 | 11·50 |
| Russia | 73·78 | 13·59 | 12·63 |
| Spain | 76·47 | 10·78 | 12·75 |
| Sweden | 76·00 | 15·50 | 9·00 |
| America, U.S. | 75·00 | 12·50 | 12·50 |
| Switzerland | 76·00 | 14·00 | 10·00 |

The English powder mills (including those at Waltham Abbey, belonging to the Government) have long been celebrated for

their powder, and, though they are now hard pressed by some of the foreign makers, they still retain the preeminence, those of Curtis and Harvey, Pigou Wilks and Laurence, and John Hall and Sons, being the chief.

The explosive force exerted by gunpowder is due to the rapid decomposition of the saltpetre by the charcoal, the oxygen of the former combining with the carbon of the latter and developing a comparatively enormous volume of carbonic acid gas, at the same time setting free the nitrogen previously held in combination with it in the nitre. The sulphur merely sets fire to the other ingredients, and causes their more rapid decomposition, at the same time increasing the expansion of the gases by raising their temperature, though it also, by its combustion, adds slightly to the amount of gas. The disagreeable smell, smoke, and black fouling are all chiefly due to the sulphur, aided in the black colour by the unburnt carbon; and for this reason the modern substitutes for black powder, which have no sulphur in them, are almost entirely free from smoke.

Black gunpowders explode at temperatures between 500° and 600° Fahrenheit, in which respect they beat their rivals, which are decomposed at about 370°. In igniting, the work is accomplished by the heated gas so rapidly as to be almost instantaneous, setting fire to each grain in succession, and the degree of rapidity is greatly influenced by the size of the grains, so that the powder maker can at will produce either a rapidly igniting powder (fine grain) or a slower one (coarse grain), the degree of slowness being in proportion to the coarseness of the grain. Thus, when the powder is ground when wet, made into a cake and dried, it does not explode at all, but burns on the surface in flashes, which consume successive layers. If, however, the cake is broken up into fragments the whole explodes on contact with fire, the rapidity depending on the size of the fragments; and if

these are in the form of fine powder the ignition will be extremely quick.

For our present purpose, namely, its use in shot guns, gunpowder is prepared as follows: The nitre is first carefully cleansed, when it is melted into cakes, which are then broken up and ground into a fine powder and sifted. The charcoal is prepared either from the wood of the alder, willow, or dogwood by burning it in iron retorts, and when cool grinding it to a fine powder. Lastly, the sulphur is refined by distillation, and then also finely ground. The three materials in their proper proportions are next thoroughly mixed in a drum with a central revolving shaft, to which numerous "flyers" are attached, the result being what is called "a charge." This is carried to the "incorporating mill," where it is still further ground with a small quantity of water, the resulting pulp being pressed into a hard cake and dried. When thoroughly brittle, the cake is broken up and the fragments sifted into the various granulated sizes, which are finally glazed by friction, with or without blacklead, when the powder of each size is put into canisters and is ready for use. In this operation a good deal of fine dust is left, which is again ground up with water into cake, and treated as before. For muzzleloaders a very fine powder was used (either No. 2 or 3), but since the introduction of the breechloader sportsmen chiefly use No. 4 or No. 6 in their shot guns. That for punt guns and rifles will be described under their respective heads. According to my experience, since the use of hard shot has been general, No. 4 suits it the best in all respects when the attempt is made to get good patterns as well as a high velocity; but for soft shot I prefer No. 6, in which the initial force developed is not so great and the shot is not so much deformed as by No. 4. Various makers have their pet fancies, such as Pigou and Wilks's "Alliance," Curtis and Harvey's "Basket" powder, &c.; but I have never discovered any great

difference between them, and in the great powder trial of 1878, conducted by me, little or no difference was found to exist between the powders of the three competitors, viz., Curtis and Harvey, Pigou Wilks and Laurence, and John Hall and Sons.

## SECTION III.

### Detonating Powder or Fulminate.

Next in order regarding the priority of invention comes detonating powder, which is used instead of flint and steel for igniting the powder whether black, Schultze, or E. C. In the early days of this invention it was used in several forms: tubes, caps, and discs, charged with fulminate, were each in turn tried, and also several kinds of fulminate, some igniting by detonation, and others by friction. At present, with the single exception of punt gun ignition, the cap is universally employed, and friction has been entirely superseded by detonation. The only question now is the degree of sensitiveness which shall be employed—a matter of some considerable importance, for, if too sensitive, the cap explodes with the slightest touch, to the great danger of bystanders; and if not sensitive enough it requires a blow which is not always easily given, on account of the nature of the lock. As an example I may cite certain hammerless guns in which the cocking is so managed that a weak mainspring is necessitated, as, for instance, in the top lever Gibbs and Pitt action. For muzzle-loaders the kind of copper has also to be considered, for if the metal is brittle the copper flies into pieces and endangers the eyes of the shooter himself. Even in breechloaders the metal must be good, or there will be an escape of gas by the side of the striker, which in hammerless guns lead to a fouling of the locks.

The composition used for charging caps varies with different makers, but in all cases fulminate of mercury and

chlorate of potass are used, sometimes with the addition of ground glass, while in others sulphide of antimony is substituted for this last ingredient. In any case the composition is mixed in a damp condition, and while in this state a small portion is dropped into the cap, dried, and varnished to protect it from the damp. When the fulminate is applied on the rim of a copper disc, as in rim cartridges, the quantity necessary for ignition is largely in excess, because it must be charged all round the rim in quantity sufficient to explode at any given point; and for this reason the cap is greatly to be preferred. As the manufacture of the detonating compound is attended with considerable danger, no amateur should attempt it; and it is therefore needless to describe it more minutely than I have now done.

## SECTION IV.

### Wood Powder.

The wood powder used in this country is almost exclusively that manufactured by the Schultze Powder Company, at Lyndhurst, Hants. About 1846, a German chemist, Herr Schönbein, discovered the explosive properties of cotton after having been steeped in nitric acid; and carrying out the same idea, wood was substituted for cotton by another German (Capt. E. Schultze, an artillery officer in the Prussian service), the resulting material, after being washed and treated in the same way as the cotton, being a powder resembling sawdust. This was tried by sportsmen in England, and found to be free from smoke, and also to give less recoil than black powder, but it never established its claim to support. After a time, a company was formed in England, with Colonel Gompertz as its promoter, and works in Hampshire, to carry out the Schultze patent; and their powder was an improvement on the original in point of form, being composed

of comparatively regular granules, instead of the fibrous ones which resulted from the first process. The improvements in its manufacture at Ringwood were regular and gradual, but as generally happens, the chemist in charge of the works (Mr. Griffiths), though well skilled in his own department, had no knowledge of the sportsman's requirements, and neither he nor Colonel Gompertz was fully able to examine the powder, when made, from a sportsman's point of view. As a consequence, it was not at first of the proper degree of "quickness," being either too slow or too rapid in its combustion. But about the year 1878, its quality had so improved, and its shooting powers *quoad* game were so lauded by Colonel Whyte and other correspondents of the *Field*, that I determined to institute a competitive trial of it in comparison with the black powder manufactured by the three leading firms—each of the black competitors to produce a choke and also a cylinder gun, and the Schultze Company, in order to have an equal chance, to produce three guns of each kind—every gun to be tried with each of the four powders. The trial came off at Wimbledon in May, 1878, the result being that, taking penetration to form the figure of merit, with deductions for variation in pattern and in recoil, the Schultze powder was beaten both in the guns made for the black powder, and in those specially made for itself. But the defeat was entirely due to the variation in pattern, which I have, since that time, shown to be due to the mode of loading up to that time adopted, and which I soon afterwards discovered to be altogether wrong. The invariable practice was to compress the powder in the cartridge case with considerable force, as it was found that, without this compression, the explosive power was very slight. Now, the compression being carried out by the hand, it was of the nature of "rule of thumb," and varied greatly; so that, as the explosive force of the powder depended on the degree of compression, it could not be relied on for regularity, and the

result was a great variation of pattern. Soon after the trial, however, I set to work, and by a long series of experiments, conducted by the aid of a simple powder gauge, which I constructed for the purpose, I ascertained and demonstrated in the columns of the *Field*, that the force of the powder does not depend on the amount of compression, but on the degree of expansion in the wad over the powder caused by it. I found that by using a larger wad without using more force than was necessary to seat it—that is to say, without any compression of the powder itself—the required explosive force was generated, and *that as a constant quantity*, and not a variable one. At first I used a thin wad about 15-thousandths of an inch larger than the No. 12 case, but ultimately I found that an ordinary 11½ pink-edged wad was the best for the purpose—this size and kind appearing not only to give a high initial pressure on ignition, but also preventing the gas from escaping by its side. Using this wad over the powder, followed by an ordinary felt wad, and a thin card wad over the shot, I found that I could get as regular patterns with the Schultze powder as with black powder, and with higher penetration, and this fact I at once announced in the columns of the *Field*; and it is now generally admitted that compression is worse than useless, and that a tight wad is the *sine quâ non* to produce strong and regular shooting with the Schultze, while it is also useful, but not comparatively to the same extent, with black powder. It is not necessary in this place to dilate on this subject, which in the spring of 1878 was a somewhat vexed one, in the columns of the *Field*. Suffice it for my present purpose to remark that I proved in 1878, and general subsequent experience has supported me, that almost, if not quite, as regular a pattern may be produced with Schultze powder as with black. In comparing the two powders it is therefore not fair *now* to import into the discussion the irregularities shown in the 1878 trial; and, as before, we

may compare the performances of the six guns shot in each class under the conditions of the 1875 trial—that is to say, omitting all deductions from the combined pattern and penetration. This was done in the report of the 1878 trial as follows:

MEAN AVERAGE FIGURE OF CHOKE-BORES IN 1878, CALCULATED ACCORDING TO THE CONDITIONS OF 1875 TRIAL.

| | Penetration. | Pattern. | Figure of Merit. |
|---|---|---|---|
| Guns shot with Schultze Powder......... | 159·08 ...... | 188·25 ...... | 347·33 |
| Guns shot with Black Powder............ | 140·00 ...... | 192·53 ...... | 332·53 |
| Superiority of Schultze Powder over Black........................ | | | 14·80 |

MEAN AVERAGE FIGURE OF CYLINDERS IN 1878, CALCULATED ACCORDING TO THE CONDITIONS OF 1875 TRIAL.

| | Penetration. | Pattern. | Figure of Merit. |
|---|---|---|---|
| Guns shot with Schultze Powder ...... | 139·33 ...... | 122·88 ...... | 262·21 |
| Guns shot with Black Powder......... .. | 135·97 ...... | 121·83 ...... | 257·80 |
| Superiority of Schultze Powder over Black...................... | | | 4·41 |

This table shows that in both classes the average penetration of the Schultze powder was considerably higher than that of the black powder, though the patterns were somewhat lower; and it is now generally admitted that, not only is the penetration as then demonstrated, but the pattern is equally good, and by some people (*e.g.*, "One Who Has Fired") considered superior to that of black powder.

The sample of Schultze powder used in the 1878 trial was a very good one, and the company would have done well to keep to it; but at the advice of a very "knowing" gunmaker Mr. Griffiths was induced to make his batch for 1879 considerably more "quick" in ignition, with the most unfortunate result that several accidents to actions and barrels occurred, but whether *post hoc* or *propter hoc* is of course doubtful. My own impression is that the latter was the cause, and this impression is rendered stronger by the fact that, since returning to the 1878 strength, no such accidents have been recorded. There seems,

however, under some conditions, to be an unusually strong explosive power generated, which is described as "detonation" by the authorities. This action I confess I do not understand, but it is explained in a very interesting letter by the gentleman signing himself "T.," to whom I have already alluded in reference to the force-gauge at page 73.

THE DETONATION OF GUNPOWDERS AND OTHER EXPLOSIVES.

The question recently asked in the *Field* as to the meaning of the word "detonation" is one of some interest, as bearing on a presumably dangerous quality supposed to be inherent in Schultze powder, and other explosives of the same class, but not to belong to black gunpowder.

It is to little purpose looking to derivation and dictionaries for information on the present meaning of the word. Old Ainsworth tells us that *detonare* means "to thunder mightily;" and Chambers's Encyclopædia, which goes more into detail than ordinary dictionaries, says that "Detonation is the phenomenon of combustion with explosive rapidity, accompanied by sound and light; thus, the firing of gunpowder, guncotton, and fulminating powders, as in a percussion cap, is detonatiou." So, according to this, detonation and explosion are one and the same thing. But, whatever may have been the case formerly, this will no longer suffice to explain all that is now intended to be conveyed by the use of the word, as a special signification has been given to "detonation" of late years, arising from the discovery that a degree of violence analogous to that of fulminating mercury may be developed in other explosive substances; and in this special sense detonation may be said to mean *instantaneous* combustion, as opposed to the *gradual* combustion ordinarily exhibited in the firing of a charge of gunpowder.

Fulminating mercury may be said always to detonate, as it is suddenly explosive whether ignited by a blow, a flame, or a wire heated by an electric battery—although its violence will vary according to the resistance offered to the escape of its gas. Black gunpowder is gradually explosive; and the larger and more dense the grains, the slower is the rate of decomposition under ordinary circumstances, while it is capable of detonation under extraordinary circumstances. In guncotton still greater diversity of action is shown, as it will smoulder, or burn very slowly, if the yarn be

merely ignited by a spark, and will inflame or burn rapidly if a light be applied to it. If confined in a gun and fired, it will explode, the rapidity of the explosion varying with the mechanical disposition of the fibres. And, finally, whether wet or dry, whether in the open air or otherwise, the guncotton may be detonated by means of a charge of fulminating mercury, and the result will be an almost instantaneous combustion of any number of pieces that may be near together. Professor Abel, the head of the Laboratory Department at Woolwich, found, in the course of his experiments, that if a succession of disks or cakes of compressed guncotton be ranged in a line, the detonation of the first will explode them all —the detonation from the one being communicated throughout the whole line (as ascertained by Capt. Noble's chronoscope) at the rate of about 20,000 feet, or nearly four miles, in a second, and consequently with about eighteen times the velocity of sound.

Heat alone does not suffice to cause this rapid explosion. The influence imparted is rather in the nature of a blow; and the rapidity of the blow considerably affects the result, in like manner as gunpowder lying on a hard surface may be detonated with greater certainty by a sharp blow from a small hammer than by a weightier but slower blow from a heavy one, or as a barrel of gunpowder may be exploded by a rifle bullet, and simply knocked to pieces by a cannon ball.

The fact that the violence of one explosive might be greatly increased by an initiative blow imparted by another, was first discovered by M. Alfred Nobel, of Hamburg—whose name must not be confused with that of Capt. Noble, the inventor of the chronoscope, and the coadjutor with Professor Abel in some very exhaustive gunpowder experiments. For a time it was supposed that nitroglycerine, to which M. Nobel had applied detonation by means of gunpowder, was the only substance thus affected; but Mr. E. O. Brown, an assistant chemist in the Woolwich Laboratory, proved that similar results could be produced with guncotton; and Professor Abel has since carried out extensive experiments with this and other explosives, particulars of which he has published in the "Philosophical Transactions" of the Royal Society. The subject has likewise been investigated by MM. Roux and Sarrau, of the Dépot Central des Poudres at Paris, who state in a paper given in the "Comptes Rendus" of the Académie des Sciences, that most explosive substances will exhibit two kinds of explosion,

according to the initiative they receive. They will *detonate* (explosion of the first order) under the influence of fulminating powder or some other violent explosive, or will *deflagrate* (explosion of the second order) as in the rapid combustion caused by the ordinary firing of gunpowder. Taking the explosive energy of black gunpowder, fired in the usual way, as representing unity, they found the same powder exhibit a force of 4·34 when detonated —or more than four times its previous strength. The following figures show the results of their experiments with regard to the more important explosives, gunpowder fired in the ordinary way being taken as the standard of comparison, and represented by the figure 1:

| | Explosive Force. | |
|---|---|---|
| | Second Order. | First Order. |
| Gunpowder | 1·00 | 4·34 |
| Guncotton | 3·00 | 6·46 |
| Nitro-glycerine | 4·80 | 10·13 |
| Mercuric fulminate | — | 9·28 |

Here it will be seen that the *proportionate* rate of increase is greater with black gunpowder than with either of the other explosives; but MM. Roux and Sarrau detonated the powder by means of nitro-glycerine. These gentlemen say:

Gunpowder, whether in grains or in dust, cannot be detonated by fulminate of mercury, but by employing nitro-glycerine as an auxiliary detonator, excited by the fulminate, an explosion of the first order is obtained, very different from the simple explosion which appears to be produced in all the conditions under which this substance has hitherto been utilised.

This appears to be at variance with the conclusions of Professor Abel, one of whose experiments with black powder was as follows: He had some iron cylinders, 4in. long, an inch in bore, and one-seventh of an inch thick, sunk into the ground and firmly rammed down in the soil, leaving only the open mouth exposed to the air, and these were filled with loose fine-grained gunpowder. One was fired by a fuse primed with meal powder, and another by a similar fuse primed with fulminate—the wire in each case being heated by an electric battery. In the first case the powder exploded with a dull report, discharging its force upwards without disturbing the soil around the tube; but in the second, where fulminate gave a sudden blow to the powder, the cylinder, although open like the other, was shattered to pieces, a large hole was made in the ground, and the soil scattered about for a long distance. Here, then, was

an enormous increase in force, although we have no figures to compare with those given above. Probably the seeming contradiction between the French and English authorities arises merely from a difference of opinion as to what constitutes a detonation; for MM. Roux and Sarrau state that, under certain conditions, impossible to fix with certainty, even fulminating mercury only gives an explosion of the second order.

It is questionable whether any distinct line can be drawn between detonation and explosion; and therefore, in making use of the word "detonation," I do so in its conventional sense rather than as having a strictly determinate meaning. The difference in the nature of the explosion seems to be mainly a difference of time; and this varies with varying circumstances. Some explosive substances disengage their gases more rapidly than others; but with each the effect produced depends upon the degree of resistance which the gases encounter as they are evolved. Fulminating mercury is rapidly explosive—so much so, that without a certain amount of resistance it will not even ignite black gunpowder. If a thin train of fulminate be laid in a line, and covered, except at one end, with gunpowder, the fulminate, on being touched at the exposed end by a hot wire, will explode throughout its whole length without igniting the powder, which is merely scattered about, and may be set fire to afterwards if collected together. Again, if a little heap of fulminate be laid on a thin sheet of metal and fired by a hot wire just touching the surface of the heap, it will explode without injuring the metal; but if the position of wire and fulminate be reversed (the heap lying on the wire instead of under it), the gas evolved cannot escape with the same facility, and the explosion will be so violent as to indent the metal deeply.* And when inclosed in an envelope, the force of its explosion increases with the strength of the envelope, from paper to wood, and from weak to strong metal, because the gases accumulate until they acquire just sufficient power to burst their bonds. The potential energy of the substance is the same, but development of force ceases when resistance ends. Even ignition in the open air does not show the lowest development of force; for if the explosive be fired in a rarefied

* Of course such experiments could not be carried out without great danger unless the wire were heated by connection with an electric battery; but I have not used the expression "fired by electricity," as it is apt to give rise to the supposition that the electricity is employed to effect a quick explosion, instead of being used merely to heat the wire.

atmosphere, as on a high mountain or under the exhausted receiver of an air pump, its violence decreases according as the pressure is reduced below the ordinary pressure of the atmosphere. This difference of resistance has an important influence on time fuses; for Quartermaster Mitchell found by some experiments carried out in India, that fuses which burnt out in 14 seconds at the sea-level required no less than 18 seconds in the hills, at an elevation of 7300 feet; and Dr. Frankland, by means of experiments in artificially rarefied atmospheres, discovered the law of this variation, which he explained in a paper read before the Royal United Service Institution. He showed that the mere change in our daily atmospheric pressures caused an appreciable difference in result, as a fall of one inch from the ordinary barometrical standard of 30 inches would decrease the time of combustion by one-thirtieth; so that a half-minute fuse would require about 31 seconds to burn out at 29 inch pressure, and rather more than 32 seconds at 28 inches. At 7300 feet the barometrical standard is rather under 23 inches, and the time occupied in combustion of the fuse was increased nearly one-fourth. The conclusions thus deduced from artificial atmospheres were verified by experiments at high elevations in the mountains of Switzerland by M. Dufour. Professor Abel's numerous experiments also give repeated confirmation of the paramount influence of resistance in developing the force of different explosives; and MM. Champion and Pellet, in a paper on the subject in the "Comptes Rendus" of the French Académie of Sciences, say that the explosion varies for the same charge of fulminate according to the resistance of the envelope—adding, however, that "whether the increase of resistance in the envelope produces new vibrations, or merely gives more intensity to those which escape, it seems impossible to decide at present."

A very curious result of Professor Abel's experiments has been the discovery that one violent explosive will not necessarily detonate another; that *quality* of "pitch," or peculiarity of vibration, is more essential to detonation than *quantity* of force: and although in some cases an increase in quantity may compensate for want of quality, yet in others it will not do so. Thus it was found that two grains of mercuric fulminate sufficed to detonate compressed guncotton; yet fifty grains of the violently-explosive chloride of nitrogen were required to produce the same effect; and, further, that nitro-glycerine, which exerts greater mechanical force than the mercuric fulminate, failed to detonate the guncotton, even

when the nitro-glycerine was increased to 500 grains and upwards—the only effect of such charges being to pulverise the cotton without exploding it; yet nitro-glycerine explodes black gunpowder readily enough. MM. Champion and Pellet ascertained that the explosion of different substances produced on sensitive flames and stringed instruments similar effects to those caused by the sounding of musical notes; and that whereas a small quantity of fulminate sufficed to produce a certain vibratory effect, others, as nitro-glycerine, had to be used in a much larger quantity, or to be brought very near to the instrument, to produce a similar effect, or any result at all.

As with fulminates, so with other explosives—a difference of circumstances greatly alters the nature of the explosion. Nitro-glycerine when unconfined is rather difficult to explode; a burning splinter of wood may be applied so as to ignite it, and it will cease to burn when the splinter is withdrawn; if a little be spilt on an anvil, the sharp blow of a hammer will detonate that under the hammer, leaving the rest unchanged; the mere flash of gunpowder appears to have no effect on it, although the explosion of a very small quantity, confined within it, will detonate the mass; even powerful electric sparks only seem to affect it when repeated with sufficient frequency to heat the mass. There is little danger from any quantity of nitro-glycerine on fire, if unconfined, as it will usually burn away without acquiring the heat necessary to explode it. It has been kept for many days at the temperature of boiling water without explosion; and dropped on a moderately hot plate with simple evaporation of the drops; but as the heat of the plate increases so does the danger of the explosion. M. Sergius Kern, of St. Petersburg, says that it boiled up and emitted strong fumes at 150° Réaumur (four degrees of which are equal to nine of Fahrenheit), exploded violently at 175° R., and still more violently at 210° R., but that at 235° R. it became comparatively feeble; and M. Kern adds that the explosive properties of the substance nearly vanish at high temperatures.

Here there would appear to be a certain similarity of result between M. Kern's experiments with nitro-glycerine and the experiments with Schultze powder narrated some months ago in the *Field* by the Editor. He found that, although some amount of compression seemed to increase the explosive force of Schultze powder, yet, by increasing the pressure, the powder was reduced to

comparative feebleness.* In both cases, possibly, the extension of explosive force beyond a certain point is only attainable by other means than heat—a sudden blow, as in detonation, being requisite. The full violence of nitro-glycerine is brought out by means of gunpowder and fulminate; and that of compressed Schultze powder, like that of compressed guncotton, would probably be brought out by the explosion of fulminate in *actual contact*. The influence of compression on guncotton is very marked. Its inertness, when very highly compressed, is so great that it may be sawed and drilled like a block of wood, and may be held in the flame of a candle without exhibiting greater signs of combustion than a piece of common deal. It may be blown to pieces by fulminate without ignition—always supposing that the fulminate is not strongly confined; and the weaker the restraint on the fulminate the greater the probability of the fragments being inflamed, but not exploded. Yet the same quantity of fulminate, if confined in a very strong metal cap, is so intensified in its action that the ignition is instantaneous throughout the cake of guncotton, and the explosive force proportionate to its previous inertness. Damp compressed guncotton is sharper in its detonation than the dry disks, owing to the greater resistance afforded by the pores being filled with water instead of air; and successive heaps of wet guncotton will carry on detonation from one to the other, providing that the one first detonated does not contain less moisture than the others.

Schultze powder, as is well known, is similar in character to guncotton, and may, to a certain extent, be expected to act in a similar way, seeing that it differs mainly in the proportion of collodion it contains, owing to the nitric acid used in the manufacture not being so strong in the one case as in the other; and the analyses published in the *Field* in 1878 showed that those samples of Schultze which were known to possess the greatest explosive force were those which contained the largest proportion of tri-nitrocellulose, or perfect guncotton, the remainder being collodion, or imperfect guncotton. It may be assumed, therefore, that the quality of transmitting detonation (supposing it to be initiated)

* Here the compression was not applied, as is frequently done, by tightly turning over the end of the cartridge case, but by pressure applied in the usual way to the wad over the powder, before the shot was put in the case. The increased force was probably due to the increased resistance arising from the expanded wad; and decrease, with further pressure, would result from closing the interstices between the grains of powder.

would be somewhat similar in Schultze and in guncotton. Yet the chances of such a result being produced by a percussion cap in a breechloading gun are beyond the bounds of probability, for the conditions essential to detonation are wanting, as will be explained further on; while the occasionally violent explosions which occur are capable of being produced by other means.

Black gunpowder, likewise, is highly susceptible to change of circumstances. The difference produced by difference of initiative explosion on the same powder is well shown by Professor Abel's experiments with the cylinders of powder, as already described; and he further showed that, where short open cylinders of fine-grained powder were fired, the one by a fuse just covered by powder at the surface, and the other by a similar fuse at the bottom of the powder, the former went off slowly, with a rushing sound like a rocket, or rather a succession of sounds, as though the powder ignited in layers; whereas a much more violent result was produced by the resistance of the superincumbent powder The mere heating of the grains of black powder also produces a great difference of effect. Mr. Bloxam, the professor of chemistry to the Woolwich Military Academy and the Department of Artillery Studies, makes the following remarks in a chapter on gunpowder in his book on Chemistry:

> In criticising all attempts to determine the pressure caused by an explosion, it must be remembered that the effects of a given pressure are very different when gradually and when suddenly applied; the same amount of force which produces little effect as a *push*, may act very destructively as a *blow*. * * * * *
>
> The same charge of the same powder produces very different results when heated in different ways. If five grains of gunpowder be placed in a wide test-tube, and fired by passing a heated wire into the tube, a slight puff is perceived; but if the same amount of powder be heated in the tube by a lamp, it will explode with a loud report, and perhaps shatter the tube. In the first case, the combustion is propagated slowly from the particle first touched by the wire; in the second, all the particles are raised at once to pretty nearly the same temperature, and as soon as one explodes all the rest follow instantaneously.

It seems possible, therefore, that barrels heated by very rapid firing might occasionally have an influence on the powder inside. One knows how soon a gun gets hot in battue shooting and grouse driving, and may imagine the effect of such an exploit as Mr. Milbank's, when 110 grouse were killed in twenty-two minutes, two guns being used. In pigeon matches against time the firing is more rapid still; and the stories we occasionally hear as to the heat of the barrels melting the solder receives some amount of

confirmation from Captain Bogardus, who says in his book, when alluding to one of his guns:

> I fancy it does not now throw its shot so close or distribute it so evenly as it did before the barrels were heated in these matches. They got so hot that the resin broiled out of the soldered joints along the rib, and in one instance burned my hand through a buckskin glove.

Of course, in breechloading guns, the paper cartridge case must delay the communication of heat; but suppose an instance where, after a gun had become greatly heated, a cartridge were left in some little time before being fired—for instance, suppose a drive with very rapid firing to be nearly over, and only single shots to occur now and then, so that the first barrel might be fired several times over, and the cartridge be replaced, whilst the other cartridge remained throughout in the hot barrel. Would not the powder get heated under these exceptional circumstances? and might not the firing of the heated charge be more sudden than any of its predecessors, and a fractured barrel be the possible result?

The difference in the rapidity of explosion of fine and coarse-grained powder is well known; but the variation caused by increased density of the powder is not so widely understood. The difference between sporting powder and that used for large artillery is not alone due to the one having grains as small as mustard seed, and the pebble and giant powder having grains of half an inch or an inch in diameter. The chemical constituents of both are no doubt practically the same; but, besides the increase in the size of the grains, there is the increase in the pressure they have undergone. In light porous powder the flash penetrates into the grain itself; and this penetration is checked by greater compression. In powder of the same density, the rapidity of combustion depends upon the amount of surface exposed to the flame. By cutting up an inch cube into half-inch cubes, there will be forty-eight sides exposed to the flame instead of six; and by cutting them into quarter-inch cubes there will be 384 sides. The sides are smaller, no doubt; yet in the last-mentioned case there are four times as many square inches of surface as there are in the first, and sixty-four times as many points of ignition.

But although fine powder will burn more rapidly than coarse, it will do so only so long as it is comparatively loose. If very tightly rammed, its condition becomes nearly that of one large grain, as the smaller the interstices the more easily they are closed against the entrance of the flash, and the rate of explosion diminishes

accordingly. For a similar reason, powders of extreme density do not answer with ordinary guns, because they burn too slowly to be consumed in the barrel; and, strange as it may seem, such powders have been improved by getting damp. In the course of some experiments formerly carried out on behalf of the United States Government, it was found that, among a number of samples that were submitted to various tests, some which had obtained a very low position when originally tried, took first rank after a lengthened exposure to damp, and subsequent drying. Then they performed a great deal better than they did as issued by the manufacturers, for the moisture had penetrated into the grain, causing it to swell, and when the moisture was afterwards expelled the grain did not diminish in size, so that the flame entered further, and it burned with greater freedom; while the great majority of the samples, which did not suffer from the defect of excessive density, all deteriorated more or less from the exposure to damp.

Taking it for granted that gunpowder, whether black or Schultze, may, under some circumstances, be capable of giving a very much more violent explosion than under others, the question arises whether one is more liable than the other to assume such a form of explosion voluntarily, so to speak; or, in other words, to "detonate" when there is no apparent difference between one cartridge and hundreds of thousands of the same kind.

Formerly I had a strong impression that a variation in the quantity of fulminate in the caps might have some influence on the force with which the Schultze powder exploded. About twelve months ago, when complaints of damage to guns were rife, I put a question on this subject to one of the Messrs. Eley, and he said that the result of constant experiments, carried out by his firm with every new batch of powder received, went to show that there was no real ground for such a supposition. A difference in strength between different batches of gunpowder was found out readily enough; but a difference between successive charges of the same powder was not observed, as would be the case if the variation of force arose from the variation of strength in the percussion cap. This went far to remove my old impression. Since then a great public trial and numerous private experiments have been carried out by the Editor of the *Field*, and when renewed complaints of accidents with Schultze powder arose, I put a similar question to him with regard to his experience. His reply was to the effect that, although he had fired about five thousand charges

of Schultze, and nearly as many more of black powder, during the past twelve months, and had carefully noted the results, he had not met with a single instance in which he could suppose that any variation in the force of explosion arose from variation in the caps. On the contrary, the results with cartridges loaded in the same way, whether tried in guns or in the pressure gauge, were so uniform as to preclude the idea of the difference between safety and danger arising from such a cause.

The practical experiences thus gained from the firing of very large numbers of breechloading cartridges would appear to be pretty conclusive, even if no scientific evidence were forthcoming to support them; but some of Professor Abel's experiments seem to bear so directly on the question at issue, that it may be desirable to allude to them. He found it very difficult to produce detonation unless there was *close contact* between the fulminate and the guncotton; and such contact is, of course, not usually found between the gunpowder and percussion powder in breechloading cartridges. If the substances are not in close contact, an exceedingly large increase in the amount of fulminate must be made in order to produce detonation; but in percussion caps the variation in the quantity of detonating composition is trifling in comparison. For example, two grains of fulminate sufficed to detonate a cake of compressed guncotton when the two were in immediate contact; but when they were placed only half an inch apart, the fulminate had to be increased fourfold to produce the same effect. In ordinary gun caps, I believe, there is only about a third of a grain of detonating composition, and this is less violent in its action than pure fulminating mercury, owing to the admixture of chlorate of potass with the fulminate, which has the double effect of increasing the heat and moderating the violence of explosion. The extent of variation in the quantity of detonating power in the same batch of caps is said not to exceed 15 or 17 per cent.; but even if it reached 50 per cent., that excess on a third of a grain would only raise the amount to half a grain. What effect, then, would such a small quantity of detonating composition be likely to have on a charge of gunpowder from which it is separated as in a breechloading cartridge? In an Eley's 12-bore case I find there is a quarter of an inch between the detonating composition in the cap and the gunpowder in the cartridge; besides which, it must be borne in mind that the full force of the detonating composition is not exerted on the gunpowder, but is mainly expended on the anvils and walls

of the cap chamber, a mere flash of heat passing through the crevices between the anvils and the perforated brass dome, so as to ignite the powder on the other side of the division. Hence it would seem that the mere variation in quantity of composition in the percussion caps of a batch of cartridges cannot suffice to make one charge of powder detonate and fracture a gun, while hundreds and thousands of similar charges produce no such effect.

Nevertheless, serious accidents do occur from time to time; and, if difference in the strength of the cap is not the cause of them, are there not other causes which may operate at wide intervals? I am inclined to think there are, both in the powder and in the cartridge cases; and the first which I will allude to is the difference in size of grain in the Schultze powder.

Black powder is carefully sifted, and you may buy No. 1 or 2, or No. 5 or 6, or larger still, of the same quality as one another, but differing merely in the size of mesh through which they will pass, and in the consequent rapidity with which they will explode. Of Schultze powder, however, you can ostensibly buy but one kind. Different batches have differed in strength beyond doubt, but whatever the batch may be—whether it explode more or less rapidly than you like—you cannot substitute one kind for another, as No. 3 for No. 5, and so on. Now, in a powder with grains of different dimensions, the disadvantage is that they have an unpleasant habit of sorting themselves—like the coals in a cellar, all the lumps at the top and the dust at the bottom. Some sportsmen like to mix their black powder, large grain and small; and very well it answers, so long as it is mixed; but it is rather awkward if one cartridge has nearly all lumps, and another nearly all dust. So with Schultze powder. Take a clear glass bottle, or a piece of glass tube stopped at each end by a cork, and, having partially filled it with Schultze powder, shake it gently, and you will soon observe all the big grains lying at the top, and the fine at the bottom. Imagine this in a powder canister. You pour out charge after charge, and stand the tin down at intervals; the first cartridges filled get more than their share of large grains, while the last are chiefly dust. If all are filled from a bowl, the liability to this is reduced, especially if stirred up occasionally; and, of course, a similar result would be obtained by an occasional shaking up of the canister.

But, over and above any difference between large and small grains as regards rapidity of combustion, it may be well to consider what

result will be produced by the powder getting inside the cap, and consequently into actual contact with the detonating composition; and likewise whether cartridge cases of any particular construction are more liable than others to have their caps filled with fine powder.

There are, as far as I am aware, but few really different kinds of cartridge cases; and of those which I have seen I have at hand but two kinds (except some Belgians not in general use); for on looking over a number of cases I found that, although names of various gunmakers were stamped on many of them, they were mostly of Eley's make, being alike in every respect except the lettering. One batch, however, marked "Greener's gas-proof," and made, I believe, by a Birmingham company, is of very different construction. The cap chamber is smaller than Eley's, and apparently stamped out of the same piece of brass as the capsule; whereas in Eley's this chamber is formed of a separate piece of metal, as will be seen by a small ring outside round the cap. But the chief difference is inside the cap. Eley's have two anvils, which are thick, and occupy nearly the whole of the space in the cap, besides projecting about a tenth of an inch. In the Birmingham cartridges the cap has but one short anvil, fixed in the centre by the edge of the cap being nipped over it. (I may mention, however, to avoid misapprehension, that I have other cases also marked "Greener's gas-proof," but evidently of Eley's make. The lettering is the same as those previously mentioned, except that there is an E above and a B under the cap, which are wanting in those of Birmingham make.)

Under ordinary circumstances, I should say that no powder would get through into the caps of either of these cases; and that there is less space for small grains to pass through in the Birmingham cartridge than in Eley's. The latter has rather the smaller hole of the two, but the hole is unobstructed, and there is a small cavity between the concave base of the anvils and the dome, in which a few small grains of powder would lie if they should pass through the hole. In the Birmingham cartridge, however, the base of the anvil usually crosses the hole, leaving only a very small opening on each side for the flash to pass through, as the base of the anvil, being convex, fits close to the curve of the dome. When the anvil is very accurately placed, as in one before me, the crevices are so minute that there seems scarcely a possibility of the smallest grain getting through; but in some cases the anvil is not quite central, and leaves rather more space; while in one very exceptional

case, also before me, the anvil is so much on one side as to be wholly invisible, and the hole is decidedly larger than the ordinary run, so that I readily passed a pin's head through, which could not possibly have been done with any of the others. I then tried the following experiment: Taking some of the finer portion of the Schultze powder, I poured it into an average Eley, an average Birmingham, and this exceptional Birmingham case, tapping each to give full opportunity for the grains to get in. In the Eley more than a dozen small grains settled just within the hole, in the concavity of the anvils; in the average Birmingham, a single small grain stuck in the crevice on one side of the hole, but without getting through; in the exceptional Birmingham, however, the cap was completely filled on one side of the anvil, and on turning out the contents I counted upwards of a hundred small grains.

Hereupon the question arises for consideration, What would have been the result of firing this exceptional cap, with the Schultze powder in immediate contact with the detonating composition, and forming, as it were, a connecting link with the main charge of powder in the cartridge?

Professor Abel has proved that guncotton conveys the detonating influence much further than fulminate; and whereas 100 grains of fulminate were required to detonate a small disk of guncotton, when they were at opposite ends of a tube six inches long, yet two grains only of fulminate, acting directly on such a disk of guncotton, transmitted detonation to a similar disk placed at the opposite end of a tube two feet in length; so that, notwithstanding the distance was four times as great, one-fiftieth part of the fulminate sufficed to produce the same effect. From which I infer that Schultze powder confined in the cap would, on being exploded, convey to the charge in the cartridge a far more forcible influence than would be produced by the percussion composition alone.

Of course such a circumstance as described can only happen at wide intervals; but the bursting of guns also occurs only at wide intervals; and I am inclined to think, if Schultze powder were used much with muzzle-loading guns, accidents would be more likely to occur in them than in breechloaders, seeing that the fine grains would have a more frequent opportunity of getting into the nipple than through the crevices of the cartridge case. I scarcely see that such an occurrence could happen with Eley's cartridges, unless one

of the anvils should chance to be omitted; but it might happen with the Birmingham cartridge, and very fine grained powder, whenever the anvil is out of the centre—which may seldom happen, but does happen occasionally, as in the case actually before me.

Another possible cause of violent explosion came under my notice in a cartridge which I opened some months since, it being one of a batch by which a gun had been burst. It contained only a small charge of Schultze powder (about 36 grains), and I should think not more than an ounce of shot, for the loaded cartridge (12-bore) was remarkably short, the end being turned over to a very unusual extent; nevertheless, the roll of paper scarcely reached the wad over the shot, and certainly did not compress the charge, as the powder (which was for the most part very fine in grain) was rather loose. The consequence in such a case would appear to be, that the fine powder, being very open between the grains, would be in a most favourable condition for igniting with extreme rapidity, and the gases evolved then meeting with sudden resistance from the curled-up end of the cartridge case, an extraordinary development of force would arise before the paper could unroll itself—the degree of force increasing, as previously indicated, in accordance with the quickness of ignition and the amount of resistance. Thus, the force of the powder would be suddenly developed in about an inch of the barrel, before the shot began to move, instead of being gradually developed, as it ought to be, throughout nearly the whole length of the barrel. The shot would, so to speak, be temporarily jammed by the suddenness of the blow, and the gases would make their way out at *the point of least resistance*—which in a strong gun might merely mean a forcing open of the cartridge in the usual way, or perhaps a dragging away of the paper cylinder from the metal base, but in a light gun would very likely mean a fracture in the barrel.

The inference I draw from this is, that it is undesirable to have the ends of cartridge cases too tightly turned over, and that, where the case is much longer than the charge, it would be better either to fill up the spare space by extra wads between powder and shot, or to cut off the surplus paper. The Editor's recent statement that the less obstruction the better in front of the shot (beyond what is actually necessary to keep the pellets in position) is borne out by theory as well as practice. The powder being firmly seated by a moderate amount of pressure, a wad of larger bore between powder and shot, as advised by the Editor, will afford ample means

for the proper development of explosive force, without the danger which may arise from too great an application of the turning-over machine.

In conclusion, I would say that I do not believe there is any danger of detonation, in either Schultze or black powder, from the mere difference in strength of caps; but I think there are other causes of occasionally rapid combustion which may be worthy of investigation. These will doubtless operate more frequently in the case of Schultze than in black powder, not only from the fact that the large proportion of dust in the former renders it more liable to rapid ignition than the larger and more uniform grain of the latter, but because any increase in strength of Schultze, proceeding from chemical constitution, is likely to arise from a nearer approach to the properties of guncotton, and consequently to be accompanied by greater rapidity of combustion. I do not, however, impute this as a matter of blame to the company that manufacture it. I look upon it rather as the result of change of circumstances, inasmuch as, under the Government regulations now in force, they can no longer manufacture the powder which they formerly made; for their powder is subjected to tests similar to those applied to guncotton, and unless it possesses a high degree of "stability," or freedom from chemical change (which in guncotton has produced spontaneous combustion), the batch is condemned. Having passed this high standard, no such result is likely to ensue as was formerly mentioned by Colonel Whyte, who had a very weak sample which he laid aside as useless, but found it wonderfully improved in strength after an interval of a couple of years or more. The test now is so severe that, when passed, no chemical change is probable in almost any number of years; but the process of manufacture is rendered more troublesome, and uniformity is in all probability more difficult of attainment. Be that as it may, however, I think there can be no doubt that Schultze is more susceptible than black powder to influence from rough-and-ready loading; and that the more powerful the sample, the quicker it resents any irregularity. Too much turning over may alone suffice to produce some of the minor unpleasant results complained of; while the serious accidents may proceed from causes such as I have indicated. At all events, I should be very glad if any experiments could be carried out to test both Schultze and black gunpowder, by filling some caps with powder before inserting them in the cartridge cases, and then load-

**ing as usual—the powder, both black and Schultze, being of very fine grain. The anvil should be unevenly placed in the cap, if the Birmingham cartridges be used, or only one anvil inserted in Eley's (as may occasionally happen in reloading, even when both were originally present); and if the hole in the dome be enlarged so much the better. Meanwhile, it would be desirable, in the case of any accident occurring with a gun in ordinary use, to observe what was the make of cartridge, and if the particular cartridge which caused the accident had the dome blown outwards or inwards, or had any irregularity in the cap. Careful observations on such points, together with the grain of the powder, and whether it is usually firm or loose in the cartridges, the nature and position of the wads, and the extent of turning over, may give a clue to what otherwise seems incapable of explanation, and perhaps may prevent blame being bestowed where it really is not deserved. T.**

Supposing the danger connected with the Schultze powder to be eliminated by the present mode of manufacture, the only drawback to its use is the necessity for keeping it until it has become "stable" in its chemical composition, the time required for which is said to be six months. At the end of that time the various samples are tested for strength in a powder gauge, and mixed in certain proportions to produce the required force, the mixture being again tested with the powder gauge and also in the gun itself by means of my force gauge. When satisfied with the result, Mr. Griffiths has the bulk put into canisters and stored ready for sale.

Dittmar's powder is very little used in this country; but in America it is very popular, or was so prior to the occurrence of some serious accidents with it. It has the great disadvantage that it is not easily measured, being very liable to variation of weight by compression. My own experience of it is *nil*.

Shortly before the *Field* trial of explosives took place in 1878, many complaints were made of the dangerous character of some of the Schultze powder which was then being sold, by which several guns were burst, and very unpleasant jarring sensations were caused in others which were strong enough to

withstand the strain. These effects were not produced by the Schultze powder generally, but only by particular samples; and therefore, besides testing them at the target, and experimenting on the effects produced by different degrees of compression in loading, I resolved to have several samples carefully examined by an analytical chemist. His report was as follows:

The main constituent of the Schultze gunpowder, as you are aware, is wood fibre, which, having first been purified, is then subjected to the action of strong nitric acid (intensified by mixture with sulphuric acid), and thus is converted into a kind of nitro-cellulose or pyroxylin, the ordinary form of which is gun-cotton. The wood fibre undergoes no change in appearance by this treatment; but a change takes place in its chemical composition, which may thus be exemplified:

| | CELLULOSE (unconverted cotton or wood fibre). | NITRO-CELLULOSE (cotton or wood fibre treated with nitric acid). | |
|---|---|---|---|
| Carbon | 6 parts | 6 parts | |
| Oxygen | 5 „ | 5 „ | |
| Hydrogen | 10 „ | 7 „ | or more |
| Nitroxyl ($NO_2$) | none | 3 „ | or less. |

It will thus be seen that the sole difference between gun-cotton or Schultze powder and ordinary cotton or wood fibre is, that some of the hydrogen is abstracted and has its place supplied by nitroxyl —a substance contained in nitric acid, and composed of one part of nitrogen united with two parts of oxygen. Under the most favourable circumstances, it is possible to replace *three* of the ten parts of hydrogen by three of the nitroxyl, when the substance produced is explosive, and is called from its composition *tri*-nitro-cellulose. This is the purest form of gun-cotton. If weaker acid is used, less hydrogen is displaced, and the product is called *di*-nitro-cellulose or *mono*-nitro-cellulose, according as it contains *two* or only *one* part of nitroxyl. These derivatives are either feebly explosive or not explosive at all. Such are the compounds known as photographic collodion and soluble gun-cotton—the latter name distinguishing it from pure gun-cotton, which is not soluble in a mixture of ether and alcohol.

The Schultze powder contains both the explosive and the non-explosive varieties of nitro-cellulose.

If the wood fibre, after being carefully purified according to the method described in Schultze's patent of 1864, were thoroughly

desiccated and allowed to cool out of contact with air, and then dipped in acid of the strength mentioned in the specification, there seems no theoretical reason why an explosive powder containing at least 90 per cent. of true tri-nitro-cellulose should not be produced. As, however, I find on experiment that nothing like that percentage is arrived at, I can only conclude that, in order to moderate the violence of the explosion, the Schultze Company secure the formation of a large percentage of "soluble" or less explosive nitro-compounds by merely air-drying their wood.

If this supposition be generally true, it seems probable that the sample of Schultze powder supplied by Messrs. Blissett* may owe its extra explosive force to exceptional care being taken, during the interval between the drying and dipping, to prevent the absorption of moisture—with the addition, perhaps, of an increased length of exposure to the action of the acid.

That some such variation of the ordinary procedure was carried out seems evident from the different proportions of soluble and insoluble guncotton in the specimens of Schultze powder supplied by Messrs. Blissett and Messrs. Bland;† for it was found that on the washed wood fibre from each being submitted to the action of a mixture of alcohol and ether, about one-half of the former powder and two-thirds of the latter were dissolved out. This shows that while the "Blissett" specimen contained about one-half its weight of insoluble or explosive nitro-cellulose, the "Bland" contained only about one-third—a difference which confirms the result obtained by analysis as stated below.

The *soluble* guncotton, ordinarily non-explosive, may, however, be rendered explosive by saturating it with bodies rich in oxygen, which promote the decomposition and complete the combustion of the fibre. Nitre is used for that purpose, because it parts with its oxygen readily; and nitrate of baryta is also used, because, being more stable than the nitre, it renders the combustion more gradual than would be the case if nitre were alone employed. When both are used, the nitre, I should think, would start, and the nitrate of baryta continue and finish the combustion of the powder. The amount used is, I suppose, the result of calculation and experiment; but a powder containing little true tri-nitro-cellulose should require

* This was a sample sent to me for examination in consequence of several accidents having followed its use.

† A sample purchased at hazard from Messrs. Bland.

more of these salts than one containing much tri-nitro-cellulose; and an excess of the salts would lower the rate of burning of the powder.

I will now give my analysis in full of the three powders, viz., (1) the ordinary powder issued last season, being part of a supply obtained from Messrs. Bland, gunmakers, of the Strand; (2) some powder furnished by Messrs. Blissett, of Holborn, and alluded to in their letter in the *Field* of Jan. 19, 1878, as having damaged a gun made by them; and (3) some of the new powder of 1878, as used at the *Field* trial of explosives in May.

| | | 1877. Bland's. | Blissett's. | 1878. Trial or New. |
|---|---|---|---|---|
| | Moisture, per cent. | 2·18 | 2·39 | 2·97 |
| Extracted by water. | Nitrate of baryta, per cent. | 21·50 | 16·59 | 22·32 |
| | „ potash, per cent. | 11·46 | 10·46 | 6·47 |
| | Yellow-coloured organic substance, trace of chlorides, &c., undetermined. | | | |
| Insoluble in water. | The converted wood fibre (nitro-cellulose) then remaining contained the following percentages of mineral matter | 5·0 | 6·0 | 2·95 |

The converted wood fibre (after allowing for extraneous mineral matter) possessed the following percentage composition. I place for comparison, in a parallel column, Professor Abel's determination of the composition of tri-nitro-cellulose, and two of the impurities found along with it.

| | Bland's. | Blissett's. | Trial or New. | Tri-nitro-Cellulose. | Impurities. | |
|---|---|---|---|---|---|---|
| Carbon | 23·75 | 28·07 | 28·12 | 24·24 | 29·20 | 30·50 |
| Hydrogen | 3·49 | 3·65 | 4·54 | 2·36 | —— | 2·91 |
| Nitrogen | 10·30 | 15·60 | 11·66 | 14·14 | 11·85 | —— |
| Oxygen | 56·06 | 52·68 | 56·63 | 59·26 | —— | —— |

These powders exploded at a temperature of about 190°C. (374°F.), the different samples varying but slightly. Pure gun-cotton is stated by Professor Abel to explode at 150°C. (302°F.); and black powders are said by different authorities to explode at various temperatures between 500° and 600°F., according to the variation in their composition and manufacture.

In addition to the difference in chemical composition of these Schultze powders, I would point out that there is a difference in density—the Blissett being heaviest, the Bland next, and the New the lightest of the three. I think this fact also has some bearing on the violence of the explosion. In black powders, I believe, a

dense powder, speaking generally, is stronger than a lighter one; and the Schultze patent states that hard woods make more explosive powders—not, I take it, because the composition is thereby altered, but because a denser powder is produced. It would appear to me, from the above analyses, that the new trial powder should contain rather more explosive force than the Bland variety, though considerably less than the Blissett. The result may, however, be modified by the difference in density of the powders; and your practical experiments will show how far this agrees with the results of the shooting.

I have hitherto only spoken of the explosive force of the powder; now I will touch on another point—its tendency to spontaneous decomposition. Knowing that, in the case of gun-cotton, its stability is injured by a small proportion of resin and other organic impurities, and by the presence of free mineral acids, I did not expect to find this powder (made from a less pure kind of cellulose, from which also it must be somewhat difficult to wash all traces of acid) equal in stability to gun-cotton; and on subjecting the three kinds of Schultze powder to the Government "heat test" of 150°F. (with a minimum of ten minutes' duration), it was found that the

| | | | |
|---|---|---|---|
| New or Trial (1878) Powder | stood the test | 12 | minutes. |
| "Bland's" sample | " | 8 | " |
| "Blissett's" sample | " | 7 | " |

This shows that the "new" powder is very stable, as it stood the test for two minutes beyond the Government minimum, while the other two samples were a good way below it. The officials at Waltham Abbey would accept no gun-cotton which did not stand the test for ten minutes; and I have seen the best gun-cotton stand it for fifteen.

Whether the loose granulated condition of the Schultze powder, when stored, is sufficient to neutralise this inferiority in purity, and render a sample of Schultze which only stands the test of seven minutes as little liable to spontaneous decomposition as gun-cotton which stands the test for ten minutes, there is at present no evidence to show.

To carry out this "heat test" properly, some practice is required; so, in order to put the matter beyond doubt, I called in the assistance of my friend Mr. Arthur Linnell, F.C.S., chemist (at that time) to the Gun Cotton Company, Stowmarket, a gentleman who was using the test daily, and who carried out the above three

experiments strictly after the manner adopted by himself and by the Government officials.

In addition to Mr. Linnell's experiments, I noticed that the aqueous extract of "Blissett" was very faintly acid; that when heated in a chest at 195°F. moist blue litmus was very quickly reddened.

I think this serious defect (want of stability) is due to want of care in the washing; and I base this opinion on the following facts:

(1) "The "Bland" and "Blissett" samples (the powders of least stability) are of a deeper tint than the "new" (due to the soluble yellow impurity before mentioned). By continued washing in warm water they become pale, like the more carefully prepared new powder, and the yellow substance is dissolved away. Hence the lighter colour of the "new" (and most stable) indicates it has less of this organic impurity.

(2) Sulphuric and nitric acids are used in the dipping of the powder, but should be entirely washed out, as they promote spontaneous decomposition. If left in, the sulphuric acid will, when the salts are added, decompose the nitrate of baryta, forming insoluble baric sulphate and free nitric acid.

On experiment I ascertained that the abnormally large quantity of mineral matter or ash (5 and 6 per cent.) found in the insoluble part of the "Bland" and "Blissett" powders *is* due to baric sulphate; and I think the acidity of the aqueous extract is due to the nitric acid thus set free.

Had this baric sulphate been present in the new powder, I should have thought it was purposely formed in all to prevent access of moisture; but, not finding this substance in this carefully prepared sample, I attribute its presence in the other cases to carelessness on the part of the workmen.

I should state that all these powders consisted of a granulated and consolidated pulp. This improvement must, I think, have considerable advantages over the sawdust form previously adopted by the Schultze Company, inasmuch as it facilitates a more thorough purification being carried out, and produces a more homogeneous and equal powder. It is possible, too, that working with pulp may be of advantage, inasmuch as the company may now, by varying the pressure in forming the cake, obtain grains of any required density.

In conclusion, I may say that, in my opinion, the most difficult task which the Schultze Company have had to encounter is that of

obtaining uniformity of strength in their explosive; and the "Blissett" sample of their powder may be looked upon as an experimental batch in which (by altering the mode of procedure in some such manner as I have indicated) they made a powder with a large percentage of tri-nitro-cellulose, thus producing a more rapidly burning substance, and consequently a more violent explosion.

Taking all things into consideration, I think the Schultze Company, in manufacturing a nitro-explosive which gives the uniformity of shooting-power shown in your recent experiments, have worked out a most troublesome problem with remarkable success. The difficulty of obtaining such results is evidenced by the fact that so many inventions of a somewhat similar character have been abandoned for sporting purposes from a deficiency in this respect.

But, however difficult it may be to manufacture a powder giving uniform shooting, it is evidently possible, with suitable care, to produce (as the "new" Schultze shows) a wood powder which is perfectly safe and stable as far as spontaneous decomposition is concerned. The company, therefore, if they have not already done so, ought to take means to prevent powder of the low stability of the "Bland" and "Blissett" samples being again issued from their works. F. WOODLAND TOMS, F.C.S., Assoc. Inst. Chem.

7, Busby-place, Camden-road, London, July 30, 1878.

P.S.—Since writing the above I have examined cursorily a sample of the "Dittmar" wood powder, an American variety of "Schultze," used by Capt. Bogardus in some of his recent shooting competitions. The powder is somewhat darker in tint, and of slightly larger grain, than the Schultze. In density it is intermediate between "Bland's" and the "New" powder; and the charge in a 20-bore cartridge was 42 grains. This powder would seem to be made from solid cubes of wood (not a pulped mass like the present "granulated" Schultze, nor sawdust splinters like the old so-called "cube" Schultze). It contains no nitrate of baryta, but has a small quantity of nitrate of potash and soda. Possessing, as it would seem, therefore, a much smaller proportion of oxidising salts than the English Schultze, it should contain, to make up for this loss of force, a larger proportion of explosive pyroxylin; but this I have not experimentally determined.

The issue of powder similar to the "Bland" and "Blissett" samples has been discontinued by the Schultze Company.

Recently I have again consulted Mr. Woodland Toms on the subject of gunpowder made from wood and cotton, and he writes as follows:

With reference to gunpowders made from wood or cotton, it may not be amiss to point out that the fibre of these two substances is chemically identical, and that the products obtained by treating these bodies respectively with nitric acid of equal strength are likewise undistinguishable one from the other. Those manufacturers, therefore, who choose cotton, do so because it affords the purest form of fibre, and therefore needs least cleansing prior to being made into gunpowder. Schultze powder, in its early days, was made from wood fibre in a condition resembling a mixture of sawdust and shreds or splinters, for which roughly cut cubes were afterwards substituted. This would be a cheap material, but on account of the large amount of gummy and other impurities that have to be removed, it requires even greater care in its manufacture than is requisite with cotton. Those persons, therefore, who do not fear Schultze need not avoid the E. C. powder simply because it is a near relative of the highly explosive substance known as "gun-cotton." This substance (scientifically called tri-nitro-cellulose) is only obtained pure by using the strongest nitric acid; and in proportion as the acid is weakened, a smaller and smaller proportion of true gun-cotton is formed, till finally, instead of pure gun-cotton, a product is obtained that does not detonate, and requires oxidising agents like nitre to facilitate its ignition and combustion. This latter product dissolves in ether or alcohol, leaving a varnish on evaporation of the solvent; and it is called by photographers "collodion" or "soluble gun-cotton." All the nitro-cellulose powders used in gunnery are therefore only diluted gun-cottons. The granulated Schultze powder now produced appears to be made from pulped wood fibre, partially converted into "gun cotton," or tri-nitro-cellulose, then mixed with nitre and nitrate of barium, and consolidated into grains by pressure. Dittmar powder consists of sawdust and sugar, compressed into thin veneer-like sheets, treated with acids, and broken up into grains, nitre being used as an oxidising agent. The Explosive Company, on the other hand, use cotton, and increase its power of ignition by similar salts to those used by the Schultze Company. The E. C. obtain evenness in density, however, not so much by solidifying the pulp by pressure, as by adding ether or

spirits of wine, which gelatinises the soluble constituents. This causes the grains to stick together after the solvent has been evaporated away, and they are accordingly separated by being rubbed through a sieve. The powder is coloured different tints according to the amount of true gun-cotton it contains, or rather, in accordance with its explosive force.

Where accidents have occurred with any such powders it has generally been traced to a desire to quicken the rate of combustion (which is surely quite unnecessary) by increasing the percentage of the more highly explosive constituents. In the sample of Schultze that caused several accidents in 1878 I found on analysis that one half of the wood fibre had been converted into true gun-cotton (*i.e.*, tri-nitro-cellulose), whereas in the ordinary samples only about one-third of the wood fibre is so converted. In a postscript to my report in 1878 I pointed out that the Dittmar powder used by Capt. Bogardus probably also contained a dangerous amount of gun-cotton. This view was afterwards confirmed by a number of accidents occurring in America from its use. It appears that Capt. Bogardus used Dittmar powder of unusual strength; but, as he used abnormally heavy guns (10lb. is a favourite weight with him), and knows well how to load with this strong powder, he met with no accident. Some of the same powder, however, got into the hands of the trade, and was sold to customers without special instructions. Many persons therefore loaded in the same way as they had previously done with the weaker powder, pressing tightly and using thick wads, and hence ensued the bursting of the guns. Professor Henry Morton, President of the Stevens Institute of Technology, showed, in a report made to the editor of the New York *Forest and Stream* (Sept. 22, 1880), that the real cause of the accident with the Dittmar powder was similar to that elicited by me in the "Blissett" sample of powder mentioned in my previous report. F. WOODLAND TOMS, F.C.S.

7, Busby Place, N.W., Oct. 5, 1882.

## SECTION V.

### THE POWDER OF THE EXPLOSIVE COMPANY, CALLED E. C. No. 12.

During the present year (1882) the Explosives Company, at their Stowmarket works, have produced with the aid of their manager, Mr. Reid, a powder which appears to rival the Schultze in its absence from smoke, diminution of recoil, and

superior penetration over black powder. It is made of several qualities, suited to shot guns and rifles, the two being differently coloured, that for shot guns being pink, while the rifle powder is straw-coloured. The new powder, which is patented by Messrs. Reid and Johnson, is composed as follows, the final specification being dated the 8th of August, 1882.

Heretofore all explosive granulated powders containing nitro-cellulose or other solid organic nitro-compounds have been comparatively loose in texture and easily compressible; so that the ballastic effect of such powders, and the strain produced by their explosion upon the barrel of the gun, varied according to the degree of compression to which they were subjected in loading the cartridge or gun.

The object of this invention is to produce a powder of hard and uniform grain, the use of which is free from the irregularities due to the variations of pressure in loading cartridges and guns.

In carrying out our invention, we take explosive powders containing nitro-cellulose or other solid organic nitro-compounds which have been granulated by ordinary and well-known methods. We moisten the granulated powder with ethylic or methylic ethers or alcohols or any mixture of these, whether with each other or with other liquids. The amount and proportion of liquid required to saturate the granulated powder vary according to the size of the grains and the nature of their composition, but from 50 to 80 parts by volume of the liquid will in most cases be found sufficient to moisten 100 parts by volume of powder granulated in the usual manner. After the addition of the liquid the powder is dried, during which process the volatile portions may be recovered and afterwards used again. The grains, which adhere slightly to each other, are then separated by rubbing them through a sieve and are ready for use. If necessary, suitable substances, which are soluble in the liquids which we employ, may be added to them for the purpose of waterproofing the powder, modifying its explosive properties; but we have found that compounds of nitro-cellulose which are hygroscopic when their texture is loose, do not absorb moisture when they have been hardened in the manner described.

The hardening of the grains of explosive powders containing nitro-cellulose or other solid organic nitro-compounds, substantially as and for the purposes hereinbefore described, is what is claimed.

The regularity of grain of the E. C. powder is of great importance both as regards the loading of the cartridges and the combustion of the charge. Not only can the rapidity of combustion be regulated by the size of grain, as in black powder; but the *hardness* of the grain can also be modified by the above process, giving an additional means of controlling the evolution of gas. There being practically no dust with the E. C. powder, all charges loaded from one tin are similar.

According to Dr. Siemens's speech to the British Association on Aug. 8, 1882, Professor Abel has recently discovered that the corrosion in the interior of the gun barrels is chiefly due to the sulphur contained in black powder. This most probably unites with the iron, forming sulphide of iron, which would be removed during the cleaning of the bore. Sulphur is quite absent from the E. C. powder, nor does it contain any substance which exerts an injurious influence upon metal. Brass cases are not discoloured by it, and the deposit in the barrel of the gun is very small. According to trials reported to me on reliable authority, the velocity of a bullet as tested by the Boulengé chronograph is about 8 per cent. greater than with black powder.

## SECTION VI.

### Relative value of the Three Explosives.

This much-vexed question is a very important one, because it may possibly lead to the selection of a powder which is dangerous in its use, on account of its superior powers as an explosive, or from its relative absence of smoke and recoil. Black powder has certainly the advantage over all of its competitors in point of safety, as far as positive proof is afforded by its long use without accidents which are incapable of explanation. Of the new E. C. powder, in this respect, little is known except that it is composed of guncotton in part, which no doubt makes it to be regarded with some

suspicion; but, as far as I have been able to learn, no approach to any accident can at present be traced to it. Still, no doubt it should be used with caution until time has proved its safety. Of wood powder, in point of safety, I have already written to the full extent of my knowledge, and I have supplemented what little I know by inserting the valuable and interesting letter of my friend "T.," and also by obtaining another highly instructive report from Mr. Woodland Toms, which is inserted at page 325. This gentleman has paid great attention to this subject at my request, in 1878 as Editor of the *Field*, and recently for the purpose of the present work. But, leaving out of the question the comparative safety of the different kinds of powder, I must now discuss their relative advantages and disadvantages in the sportsman's hands. On first hearing of the new explosive I proceeded to examine into its nature, and was most favourably impressed with its powers; but the gun with which the manager of the works (Mr. Reid) conducted his experiments not being first-class, I could not come to any positive conclusions; and not being myself able to carry the experiments farther, I commissioned Mr. Jones, of Birmingham, who undertakes to try guns for the public, to test it fully in a first-class gun. This he did at once, and the following is his report, published in the *Field* of July 29, 1882.

Sir,—In accordance with your request, I herewith beg to hand you the results of my experiments with the new gunpowder, No. 12 E. C., sent to me by the Explosives Company, Limited, Stowmarket, for trial. In order to obtain some idea of the comparative value of this new explosive, I tested it against equal loads of Schultze and a proportionate quantity of C. and H., No. 4, T. S. powder. For these experiments I used the right barrel of my double gun, specially bored and chambered for Kynoch's 14-gauge "Perfect" shell—weight of gun, 6¾lb., 30in. barrels, 40 yards' range; 1⅛oz. of No. 6 chilled shot of 270 pellets per ounce. All the charges of powder and shot were correctly weighed on finely-adjusted scales. The 10in. shot-plate of the force gauge was let into a

specially-constructed target, which enabled me to take the pattern and force with great facility. I could not distinguish any difference in recoil or amount of smoke between the Schultze and the No. 12 E. C. powder.

The Explosives Company have also sent me another sample of their powder (No. 16) to report upon—said to be better when cartridges are loaded by measure—but it arrived too late for me to test for this week's publication. I will, however, test it, and will send you results early next week. W. P. JONES.

75, Bath-street, Birmingham, July 26, 1882.

No. 1 EXPERIMENT, WITH 42GRS. SCHULTZE.

| Scale. | 10in. Plate. | Force. | Pattern. |
|---|---|---|---|
| 95 | 39 | 2·44 | 236 |
| 107 | 46 | 2·33 | 228 |
| 93 | 42 | 2·21 | 219 |
| 124 | 53 | 2·34 | 235 |
| 110 | 45 | 2·44 | 223 |
| 105 | 48 | 2·19 | 218 |
| | | 6)13·95 | 1359 |
| | Average ...... | 2·32 | 226·5 |
| | Highest ...... | 2·44 | 236 |
| | Lowest ...... | 2·19 | 218 |

Figure of merit—459

No. 2, WITH 42GRS. No. 12 E. C. SPORTING EXPLOSIVE CO.'S.

| Scale. | 10in. Plate. | Force. | Pattern. |
|---|---|---|---|
| 87 | 39 | 2·23 | 221 |
| 113 | 49 | 2·31 | 228 |
| 128 | 59 | 2·17 | 237 |
| 143 | 59 | 2·42 | 219 |
| 110 | 48 | 2·29 | 221 |
| 97 | 41 | 2·36 | 230 |
| | | 6)13·78 | 1356 |
| | Average ...... | 2·29 | 226·0 |
| | Highest ...... | 2·42 | 237 |
| | Lowest......... | 2·17 | 219 |

Figure of merit—455

No. 4 EXPERIMENT, WITH 46GRS. SCHULTZE.

| Scale. | 10in. Plate | Force. | Pattern. |
|---|---|---|---|
| 126 | 51 | 2·47 | 220 |
| 130 | 53 | 2·45 | 224 |
| 124 | 51 | 2·43 | 229 |
| 115 | 50 | 2·30 | 220 |
| 147 | 61 | 2·41 | 240 |
| 205 | 78 | 2·62 | 261 |
| 175 | 64 | 2·73 | 234 |
| 117 | 51 | 2·29 | 218 |
| 128 | 52 | 2·46 | 229 |
| 117 | 50 | 2·34 | 212 |
| | | 10)24·50 | 2287 |
| | Average ...... | 2·45 | 228·7 |
| | Highest ...... | 2·73 | 261 |
| | Lowest......... | 2·29 | 212 |

Figure of merit—473

No. 5, WITH 46GRS. No. 12 E. C. SPORTING EXPLOSIVE CO.'S

| Scale. | 10in. Plate. | Force. | Pattern. |
|---|---|---|---|
| 144 | 56 | 2·57 | 243 |
| 148 | 57 | 2·60 | 237 |
| 130 | 51 | 2·55 | 221 |
| 118 | 48 | 2·46 | 217 |
| 159 | 61 | 2·61 | 238 |
| 109 | 46 | 2·33 | 220 |
| 128 | 52 | 2·46 | 222 |
| 139 | 54 | 2·58 | 232 |
| 90 | 43 | 2·09 | 201 |
| 120 | 47 | 2·55 | 222 |
| | | 10)24·80 | 2253 |
| | Average ...... | 2·48 | 225·3 |
| | Highest ...... | 2·61 | 243 |
| | Lowest......... | 2·09 | 201 |

Figure of merit—473

No. 3, with 3drs. C. & H. No. 4 T. S. Black.

| Scale. | 10in. Plate. | Force. | Pattern. |
|---|---|---|---|
| 130 | 57 | 2·28 | 237 |
| 113 | 48 | 2·35 | 211 |
| 124 | 50 | 2·48 | 220 |
| 119 | 48 | 2·48 | 217 |
| 104 | 48 | 2·17 | 242 |
| 113 | 49 | 2·31 | 228 |
| | | 6)14·07 | 1355 |
| | Average ...... | 2·34 | 225·8 |
| | Highest ...... | 2·48 | 242 |
| | Lowest......... | 2·17 | 211 |

Figure of merit—460

No. 6, with 3½drs. C. & H. No. 4 T. S. Black.

| Scale. | 10in. Plate. | Force. | Pattern. |
|---|---|---|---|
| 126 | 50 | 2·52 | 234 |
| 118 | 43 | 2·75 | 219 |
| 131 | 57 | 2·30 | 228 |
| 100 | 43 | 2·33 | 206 |
| 111 | 46 | 2·41 | 218 |
| 113 | 48 | 2·53 | 235 |
| 110 | 46 | 2·39 | 220 |
| 113 | 48 | 2·35 | 253 |
| 110 | 47 | 2·34 | 226 |
| 113 | 51 | 2·22 | 232 |
| | | 10)24·14 | 2271 |
| | Average ...... | 2·41 | 237·1 |
| | Highest ...... | 2·75 | 253 |
| | Lowest......... | 2·22 | 206 |

Figure of merit—468

By this trial my favourable opinion, formed at Stowmarket, was corroborated, the following being the averages of the three high and low charges of each powder.

| | Average Force. | Average Pattern. | Figure of Merit. |
|---|---|---|---|
| Schultze, 42grs................ | 2·32 | 226·5 | 458·5 |
| E. C. Powder, 42grs.......... | 2·29 | 226 | 455· |
| Black Powder, 3drs.......... | 2·34 | 225·8 | 459·8 |
| Schultze, 46grs................ | 2·45 | 228·7 | 473·7 |
| E. C. Powder, 46grs. ...... | 2·48 | 225·3 | 473·3 |
| Black Powder, 3½drs. ...... | 2·41 | 227·1 | 468·1 |

It appears from this trial that the new powder is almost identical in its powers with the Schultze, and in the higher charge stronger than black powder. The difference between the three is, however, scarcely worth taking into consideration, except as to force, in which the E. C. powder, 46 grains, shows its superiority very decidedly. In regard to the absence of smoke, which is very important in using the second barrel, both these new powders are, however, so far superior to the old black that there is no comparison between them; and, irrespective of danger, the latter would stand no chance whatever with the sportsman.

## SECTION VII.

### Varying Weight of Gunpowders.

About the time of the *Field* trial of explosives in 1878, complaints were rife with respect to cartridges loaded with improper charges of Schultze powder, owing to many measures in use being of different size, although marked for the same quantities. This appears to have arisen from the changes that had taken place in the manufacture of that explosive, whereby the density of the powder was changed, and consequently measures that had been made to hold 42grs., 45grs., &c. of Schultze when the powder was light, contained a much larger weight when the powder was heavier. A comparison being made with many different samples of powder, it was found that not only had the Schultze widely varied in density, but that the black powder also differed to an extent that was little dreamed of by most sportsmen, as will be seen by the following remarks on the subject :—

There is, as far as I know, no definite rule for determining the capacity of measures which are made for black powder, still less for Schultze; and if a maker takes for his standard any one sample of powder, it will not only vary considerably from other samples, but the same measure of the same powder will vary in weight according to the manner of filling—two or three sharp taps being much more effective in settling down the powder than a much larger number of feeble taps.

It is often remarked that sportsmen cannot take the trouble to weigh charges when loading their cartridges; and I have heard it said that to weigh every charge at the *Field* gun trials was carrying accuracy to a needless degree of nicety; but, without pretending that it is requisite to weigh all charges under ordinary circumstances, I am of opinion that it is desirable to weigh a charge or two on purchasing a new measure, or on getting a new kind of powder, so as to know what quantity you really are using; and with regard to competitive trials, the necessity of weighing the charges

in such cases was never so clearly brought to my mind as by carrying out the experiments which I am about to describe.

The Editor kindly placed at my disposal various samples of powder, for comparison with regard to weight, and I have supplemented them by others in my possession. For convenience of weighing on a delicate balance, and to prevent any possibility of spilling, I adopted, instead of an ordinary powder measure, a small stoppered bottle, which would hold $3\frac{1}{2}$drs. of black powder, more or less. I say "more or less" advisedly, for, notwithstanding the general impression that 3drs. or $3\frac{1}{2}$drs. is a definite quantity, I found that this measure would contain, of one sample, nearly $3\frac{3}{4}$drs. by weight, whereas about $3\frac{1}{4}$drs. of another sample sufficed to fill the measure—a fact which I venture to think will be a surprise to others, as it was to myself. Accordingly, if two such samples had chanced to be put in competition at the gun trial, the mere measuring of the powder would have afforded no fair comparison of the actual quantity used in the respective charges.

I found, moreover, by filling the same measure several times in succession, that there is great difficulty in obtaining exactly the same results, even if the utmost care be used. In order to obtain uniformity, I adopted the following process. The glass bottle which I used as a $3\frac{1}{2}$ drachm measure was closed by an accurately-fitting stopper, which served as a gauge, for I filled the bottle with the powder till it was on a level with the neck and just touched the stopper—tapping the bottom of the bottle on the table in order to settle the powder down equally. If I found there was room for an atom or two more of powder under the stopper, I made the addition; and if I found the stopper would not go fairly in without pressing down the powder, I removed a small quantity. Yet, with all these endeavours to secure exactness, I could not obtain absolute uniformity of result; for successive measures from the same sample sometimes varied quite a grain in weight, and that with a balance which would weigh to the thousandth part of a grain. If, then, such be the result of my attempts to secure uniformity, how much more likely to vary would be charges measured in a rough-and-ready fashion, without any special attempt at accuracy? No doubt it may be said that one grain out of ninety or a hundred is only a trifling divergency, and with common scales such differences would be much less apparent, or scarcely noticeable; still it must be observed that this difference was between charges supposed to have received exactly the same

handling; and when there was purposely a difference in manipulation (the powder being gently poured in without shaking) there was a marked change in the result, more especially with powders of low density, the variation being sometimes six or seven grains instead of one.

The difference in the weight of the powder does not depend merely upon the size of the grain, as is commonly supposed, but mainly upon its density. On sifting, however, the large grains from the small, in some granulated Schultze, I found the large were decidedly the heavier; but the mixture of the two was heavier than either taken alone, as the fine dust would lie between the large grains, and consequently add to the weight.

Of the black powders I weighed ten samples, and the heaviest and lightest were of the same sized grain—No. 2; for so I class the heaviest of the lot, Curtis and Harvey's "medium basket grain," which has no number, but is of just the same size as the Kames Company's "Medium No. 2," the lightest of the lot—the latter a sample of powder made some half-dozen years ago. The ten samples comprised two of each size, from No. 2 to 6, by various makers, and the results of the weighings of the same bulk of each, well shaken down, are here given in grains. The shaking down was decidedly greater than would be given in ordinary loading; but with less shaking the divergency would have been even greater, from the light powder lying so much more loosely than the heavy.

| | | | | Lightest. | | Heaviest. |
|---|---|---|---|---|---|---|
| 3½drs. | measure of | No. 2 | weighed | 92 grains | ......... | 101 grains. |
| " | " | No. 3 | " | 94½ " | ......... | 99 " |
| " | " | No. 4 | " | 93 " | ......... | 94 " |
| " | " | No. 5 | " | 95½ " | ......... | 97½ " |
| " | " | No. 6 | " | 97½ " | ......... | 98 " |

For comparison, I may mention that $3\frac{1}{2}$ drachms avoirdupois are equal to $95\frac{5}{8}$ grains.

When there is so much divergency in different samples of our old friend the black powder, which is ordinarily looked upon as a model of regularity, we may naturally expect a much greater difference in its modern rival, which has undergone so many modifications in a few years. When imported from Germany it was a "fluffy" kind of powder, of an orange-brown tint, and so light that about 25 grains sufficed to fill my $3\frac{1}{2}$ drachm bottle; but it will shake down to almost any extent, and I gave it up at about 33 grains with the conviction that it would take much more. Of

English manufacture there was a very similar powder as regards appearance, except that its colour was a dull yellow. Then there was a cubical or sawdust-looking powder; and of this, issued about 1872, I find the bottle will hold 42 grains. How many more varieties there have been, I cannot undertake to say.

With the granulation of the powder, however, one former objectionable feature is removed, as the samples I have examined now shake down only to a comparatively small extent—less, in fact, than some samples of black powder. But the granulated powder is, as a rule, considerably heavier than the old or sawdust powder. One sample, issued in 1877 or the previous year, and about which complaints were very rife, is heavier than any other sample I have met with—the $3\frac{1}{2}$ drachm bottle containing $52\frac{1}{2}$ grains; and as this was also stronger, weight for weight, than its predecessors, accidents will be readily accounted for, if persons loaded with the same bulk as before, as they would be using a much larger quantity than was intended. Another sample, issued in 1877, was decidedly lighter, the bottle only containing $49\frac{1}{2}$ grains. This was followed by the powder made for the *Field* trial of May, 1878. It was lighter in colour, and I think a trifle heavier in weight, than that of the previous year; but they are so near together that I hesitate to say whether the difference in result is due to the powder or to slight differences of manipulation in filling the measure. With the last issue, however (November, 1878), there is again an increase in weight as well as strength, though not to the same extent as that complained of a year or two since, the weight here being 51 grains.

I think it is a great pity that the Schultze Company should have made this increase in the density of their powder. Such an increase seems to be always accompanied by increase of violence—a quality to be avoided as much as possible. T.

The manufacture of the denser powder last mentioned was afterwards given up, and the Schultze Company have since issued powder which has been much more regular and satisfactory than it ever had been before in this respect.

Another matter which has puzzled many persons who have tried to weigh their powder is the weight represented by the word "drachm." In numerous instances sportsmen who have wished to try their guns carefully, and have weighed their powder instead of using a measure, have found 3 drachms

of powder fill the cartridge case, without leaving any room for the shot. They had, in fact, made use of apothecaries' weights instead of avoirdupois weights. An inquiry on this subject by a German sportsman led to the following information being given in the *Field*, as before by my valued friend "T."; and it may be of service to many others, both at home and abroad, if it be reprinted:

We are by no means surprised to learn that a foreign reader finds it difficult to understand English weights, seeing that many of our own countrymen are likewise puzzled thereby, owing to the absurdity of different systems being in operation, and making use of the same words to represent widely different quantities. Thus one pound (avoirdupois), of 7000 grains, is divided into 16 ounces of 16 drachms each (or 256 drachms to the pound); and another pound, of 5760 grains, is divided into 12 ounces of 8 drachms each (or 96 drachms to the pound) when used as apothecaries' weight, whilst this same pound is divided into 240 pennyweights when used, under the name of troy weight, by goldsmiths and jewellers. Here, then, we have the anomaly of a large pound with small ounces and drachms, and a small pound with large ounces and doubly large drachms. No wonder that we occasionally receive letters from bewildered correspondents, who, having got a friendly apothecary to carefully weigh for them $3\frac{1}{4}$ drachms of black powder, find that the cartridge case will not hold it—which is not surprising, seeing that $3\frac{1}{4}$ drachms apothecaries' weight are equivalent to about $7\frac{1}{4}$ drachms avoirdupois. In a similar fashion, our present correspondent has been misled by the table of weights which he quoted in his letter. We may therefore state that, for gun charges, the system of weights employed is that used for all general domestic and commercial purposes, viz., avoirdupois weight; while the two other systems are specially applied, the one to medicines, and the other to precious metals and jewels.

In compliance with our correspondent's request, we now give a short table of the weights most generally used for ordinary charges of powder and shot; and we add their metric equivalents, for more ready comparison by foreign readers. In giving the grains, we do not go to the minuteness of decimal fractions, as $27\frac{1}{3}$ grains vary only to a very trifling extent from the exact equivalent of the

drachm (27·34375 grains), and the former fraction is much more comprehensible to those readers who are not familiar with decimals. The metric weights are given to the nearest milligramme.

| Black Powder. | | | | | Schultze. | | | Shot. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drachms. | | Grains. | | Grammes. | Grains. | | Grammes. | Ounces. | | Drachms. | | Grammes. |
| 1 | ... | $27\frac{1}{3}$ | ... | 1·772 | 1 | ... | 0·065 | $0\frac{7}{8}$ | ... | 14 | ... | 24·806 |
| $2\frac{3}{4}$ | ... | $75\frac{1}{5}$ | ... | 4·872 | 38 | ... | 2·462 | 1 | ... | 16 | ... | 28·350 |
| 3 | ... | 82 | ... | 5.315 | 42 | ... | 2·722 | $1\frac{1}{8}$ | ... | 18 | ... | 31·894 |
| $3\frac{1}{4}$ | ... | 89 | ... | 5·758 | 46 | ... | 2·981 | $1\frac{1}{4}$ | ... | 20 | ... | 35·437 |
| $3\frac{1}{2}$ | ... | $95\frac{3}{4}$ | ... | 6·201 | 50 | ... | 3·240 | $1\frac{3}{8}$ | ... | 22 | ... | 38·981 |

We have given the Schultze at intervals of 4 grains, which are about equivalent to a quarter of a drachm of black powder; intermediate quantities can be calculated from the unit, one grain being slightly under 65 milligrammes (·064799 gramme).

The specific gravity as well as the strength of Schultze powder varies somewhat in different samples; and in black powder also there is some variation in weight with the size and density of the grain; but for ordinary purposes the weight of Schultze may be taken as about half that of black powder, and, consequently, a measure holding 3 drachms of black powder would only contain about $1\frac{1}{2}$ drachms or 41 grains of Schultze. It is a common practice, however, for sportsmen to say that they fire "3 drachms" or "$3\frac{1}{4}$ drachms" of Schultze in a 12-bore gun, because, in loading, they have used a black-powder measure marked with these weights; but those who do so might with equal accuracy say that they fire "an ounce" or "an ounce and a quarter" of Schultze, if they were to make use of a measure marked for shot instead of powder.

# CHAPTER XI.

## SHOT.

### SECTION I.

#### VARIETIES OF SHOT.

SHOT varies in degree of hardness as well as in size.

In reference to hardness, until the introduction of the choke-bore all shot used in sporting guns was made of lead without any alloy, but it was found at that time that a harder metal suited the new bores better; and ever since, a hardened shot, or that of the Newcastle company called "chilled shot," has been very generally used, not only in choke-bores, but also in cylinders.

All shot is made by dropping melted lead from a height, the tendency in all liquids to assume a spherical form when only in contact with air being exemplified in metal. In America—and it was at first said also at Newcastle—a blast of cold air is admitted to the shot as it falls, which is said to harden it, but I believe in reality all English hard shot is made so by an alloy of some kind, and not by really chilling the shot with cold air. At all events, other makers—notably those of Walker, Parker, and Co., and Lane and Nesham, of London—produce, by means of alloy, shot with all the qualities displayed by the Newcastle company.

In all cases, whichever hard shot is used, the specific gravity is less than that of lead; and, consequently, where the numbers

per ounce are the same, the size per pellet will vary. The difference in hardness is not so great as entirely to prevent the spread of the pellets on striking iron, and the variation is less in the chilled or hard shot than in the unalloyed leaden pellets. The sizes vary from A A A A of the London companies, of 30 per ounce, to small dust shot, which is about 3000 per ounce.

The following are the respective sizes and numbers:

| Newcastle Chilled Shot. | | Walker, Parker, and Co., London. | | Lane and Nesham, London. | |
|---|---|---|---|---|---|
| Size. | No. of pellets per oz. | Size. | No. of pellets per oz. | Size. | No. of pellets per oz. |
| A A A | 40 | Mould Shot. | | A A A A | 30 |
| A A | 48 | | | A A A | 35 to 40 |
| A | 56 | L G | 5½ | A A | 40 |
| B B B B | 56 | M G | 8⅓ | A | 45 |
| B B B | 64 | S G | 11 | B B B | 50 |
| B B | 76 | S S G | 15 | B B | 58 |
| B | 88 | S S S G | 17 | B | 75 |
| 1 | 104 | | | 1 | 80 |
| 2 | 122 | Drop shot. | | 2 | 112 to 120 |
| 3 | 140 | | | 3 | 135 |
| 4 | 172 | A A | 40 | 4 | 175 to 180 |
| 5 | 218 | A | 50 | 5 | 218 to 225 |
| 6 | 270 | B B | 58 | 6 | 278 to 290 |
| 6* Northern size. | 300 | B | 75 | 7 | 340 |
| 7 | 340 | 1 | 82 | 8 | 462 |
| 8 | 450 | 2 | 112 | 9 | 568 |
| 9 | 580 | 3 | 135 | 10 | 985 |
| 10 | 850 | 4 | 177 | Dust | 1762 |
| 11 | 1040 | 5 | 218 | | |
| 12 | 1250 | 6 | 270 | Mould Shot. | |
| Large Dust. | 1700 | 7 | 341 | | |
| Small Dust. | 2800 to 3000 | 8 | 600 | S G | 11 |
| | | 9 | 984 | S S G | 15 |
| | | 10 | 1726 | S S S G | 17 |
| Mould Shot. | | Dust Shot. | Variable. | L G | 5½ |
| | | | | M G | 9 |
| S G | 8 | | | | |
| S S G | 11 | | | | |
| S S S G | 14 | | | | |

American shot varies still more than the English, and is not so regular in shape. The sizes of the principal American makers are as follows:

| Size. | Leroy and Co. | Tatham Bros. | St. Louis. | Size. | Chicago. |
|---|---|---|---|---|---|
| T T | 32 per oz. | 31 per oz. | 33 per oz. | O O O | 27 per oz. |
| T | 38 ,, | 36 ,, | 39 ,, | O O | 33 ,, |
| B B B | 44 ,, | 42 ,, | 46 ,, | O | 38 ,, |
| B B | 49 ,, | 50 ,, | 51 ,, | B B B | 46 ,, |
| B | 58 ,, | 59 ,, | 60 ,, | B B | 53 ,, |
| 1 | 69 ,, | 71 ,, | 71 ,, | B | 62 ,, |
| 2 | 82 ,, | 86 ,, | 90 ,, | 1 | 75 ,, |
| 3 | 98 ,, | 106 ,, | 100 ,, | 2 | 92 ,, |
| 4 | 121 ,, | 132 ,, | 118 ,, | 3 | 118 ,, |
| 5 | 149 ,, | 168 ,, | 159 ,, | 4 | 146 ,, |
| 6 | 209 ,, | 218 ,, | 237 ,, | 5 | 172 ,, |
| 7 | 278 ,, | 291 ,, | 299 ,, | 6 | 216 ,, |
| 8 | 375 ,, | 399 ,, | 385 ,, | 7 | 323 ,, |
| 9 | 560 ,, | 568 ,, | 509 ,, | 8 | 434 ,, |
| 10 | 822 ,, | 848 ,, | 700 ,, | 9 | 596 ,, |
| 11 | 982 ,, | 1346 ,, | 1103 ,, | 10 | 854 ,, |
| 12 | 1778 ,, | 2326 ,, | | 11 | 1414 ,, |
| | | | | 12 | 2400 ,, |

When the shot has been dropped into the water at the bottom of the shaft, it is collected and passed through sieves in succession, the smallest of course passing through the finest sieves, and each batch being collected by itself to be put aside as belonging to the number represented by that sieve. It is, however, only by actually counting that the result of any sifting can be ascertained with certainty in point of numbers.

## SECTION II.

### Velocity of Shot.

Upon the velocity with which shot travels to the object aimed at depends its killing power, assuming the weights to be equal. The force of the blow given will, however, vary in proportion to the weight per pellet. Here, again, however, I shall avail myself of the valued services of my friend "T.," as well as those of Mr. Rigby and Mr. Griffith, both of whom have tested shot with the Boulengé chronograph.

Until about three years ago very little was known about the velocity of the pellets fired from shot guns; and most extravagant assertions have been made on the subject. With mili-

tary weapons it was very different, the initial velocity of the bullets fired from the Snider-Enfield and Martini-Henry rifles having been very accurately determined, the Government Text-book for the Use of Officers at Schools of Musketry giving the former at 1250 to 1290 feet, and the latter as 1290 to 1340 feet per second, according to the density of the powder used.

The *initial* velocity of charges of loose shot has not even yet been determined; but that of spherical bullets, fired from a smooth bore, was ascertained at Messrs. Holland's trial of sporting rifles, carried out under my supervision, and reported on in the *Field* of Nov. 22nd, 1879. There was, however, but one smooth-bore gun fired, viz., one of 10-gauge, which was shot with 8drs. of powder, and showed a velocity of 1470 feet per second, a rifle of the same bore, fired with similar bullet and charge of powder giving 1460 feet, or only 10 feet less velocity. With 12-bore rifles, fired with 4drs., 5drs., 6drs., and 7drs., the velocities were respectively 1156, 1270, 1395, and 1481 feet per second. These velocities were taken at 35 yards; and the corresponding initial or muzzle velocities, as ascertained by calculation, would be respectively 1309, 1447, 1595, and 1696 feet per second.

The first positive information made known with respect to the *mean* velocity of charges of small shot was contained in the following letter from Mr. Rigby in the *Field*.

Sir,—It is not strange that there should be "One Sorely Perplexed" on this subject when estimates of the time of flight for forty yards vary so widely among your correspondents as from one-fifth of a second to one-tenth, and in Mr. Dougall's case to one-nineteenth of a second.

I have ascertained the true time by the chronograph, and it varies, with the charges in general use, from one-sixth to one-seventh of a second, the latter being the time for a good 12-bore, with $3\frac{1}{4}$drs. and $1\frac{1}{8}$oz. of No. 6 shot. These times correspond to a mean velocity of 720ft. and 840ft. per second respectively, which are of course higher than the final or striking velocity at forty yards.

Your correspondent "T.," in seeking to deduce the latter from the indications of your instrument, has made no allowance for the force with which the pellets recoil from the plate, an item which must be taken into account, as it has no certain relation to the recoil of the hammer used to fix the scale of force ounces.

72, St. James's-street, May 13th, 1879. JOHN RIGBY.

Mr. Rigby's ascertained results, with regard to the mean velocity of the pellets, being obtained by the chronograph, may be accepted as conclusive. They go to confirm "T.'s" calculations with regard to the final or striking velocity at 40 yards, so far as one can judge by inference. In these calculations, as Mr. Rigby points out, no allowance was made for the force with which the pellets recoil from the plate; but neither was any allowance made for the force with which the hammer recoils. To be minutely accurate, no doubt these should be taken into consideration; but "T." informs me that he intentionally avoided any allusion to this part of the subject, as only likely to complicate the question, without any corresponding advantage. In both cases the recoil is chiefly due to the elasticity of the spring which backs up the plate; and this elasticity is constant, whether the blow is from the shot or the hammer. Between the shot and the hammer there is, however, a difference of elasticity arising from the difference of material from which they are made; but this is not sufficiently large to interfere very materially with the general result.

The last paragraph of Mr. Rigby's letter refers to a communication in a previous issue, which has been already alluded to by Mr. Griffith (page 39, *ante*), and which it may be as well to reprint here. It suggests, as will be seen, a mode of ascertaining the *final* velocity of shot at 40 yards, taking as its basis the results recorded by the *Field* force gauge.

It was with some interest that I read the remarks of "Experiment" in the *Field* of April 12th, 1879, where (writing on the subject of "Shooting in Front of your Bird") he said that he had taken considerable pains to ascertain the time of flight of No. 6 shot from a 12-gauge breechloader, with charges of $1\frac{1}{8}$oz. shot and 3drs. powder, and that he found the time for 40 yards was almost exactly one-fifth of a second. For my own part, I should have supposed that the time would have been somewhat less, as the above

time would give a *mean* velocity of 600ft. only, whereas my impression has been that this would be about the *final* velocity of the pellets at a 40 yards range.

My impression in this respect receives some confirmation from what appears to me to be a very easy mode of calculating velocity from the working of the "force gauge" used during the Gun Trial. It is simply an adaptation of the principle that, as the *momentum* of a moving body is the product of its *weight* multiplied by its *velocity*, you may, when both momentum and weight are known, ascertain the *velocity* by dividing the former by the latter. The tables given in the report of the Gun Trial supply the necessary particulars, as the numbers recorded on the "force gauge" are units of *momentum*, based on the ounce. These units having no recognised name, the Editor has designated them "force ounces," and I shall here adopt his expression for the sake of distinctness. The *weight* is of course ascertainable from the number of pellets, there being 270 to the ounce of the No. 6 shot used at the trial, and each pellet, supposing them all to be equal, is therefore $\frac{1}{270}$oz., and 60 pellets are $\frac{60}{270}$oz.

I need scarcely state that, in dividing a number (say 131) by a fraction (say $\frac{60}{270}$), the number is divided only by the top figures or numerator, and is multiplied by the lower or denominator. In the report of the Gun Trials, however, the first portion of this work has already been done for us by the calculation of the force per pellet, and, consequently, we have merely to do the multiplication by 270.

The remaining process, therefore, is simply as follows: *Take the ascertained force per pellet, multiply it by the number of pellets in the ounce, and the product is the velocity with which the shot struck the plate.*

Taking, for example, the first shot with the right barrel of Messrs. Trulock and Harris's 12-bore gun (see page 61), we find that 37 pellets struck the 10-inch plate, and 74 was marked on the gauge, or exactly 2 force-ounces to each pellet. Multiplying 2 by 270, we get 540ft. per second, as the velocity with which these 37 pellets struck the plate. Here the calculation is so easy that it may be done in the head, without resorting to pen and paper. But the first shot with the left barrel is more difficult, as 131 force-ounces were marked on the gauge by the blow of 60 pellets; hence the force per pellet was 2·18, which, being multiplied by 270, gives 589 velocity, omitting fractions of a foot.

Many who read this, but have not read the description of the

force-gauge, will doubtless be disposed to ask why it is assumed that the 540 and 589 mentioned above are taken to represent velocity. I may therefore explain that the new "force gauge" is based upon the fact that the momentum of any body is proportionate to its velocity and weight; and it is upon the same principle that the foregoing calculation is based.

For full particulars respecting the "force-gauge," I must refer the reader to the editorial article and accompanying illustration; but I may here briefly state that the scale of the machine is marked in accordance with the effects produced by hammers of given weights striking against the shot-plate with a given velocity. Thus, a 2oz. weight with 8ft. velocity marks 16 force-ounces on the scale; 4oz. × 8ft. velocity marks 32; 8oz. × 8ft. marks 64; and so on. If a result equal to either of these (say 64 force-ounces) be produced by a blow from a body of less weight than above stated, such result must have been produced by an increase of velocity corresponding with the decrease in weight. Accordingly, if the body weigh only 1oz. instead of 8oz., the velocity required to mark 64 force-ounces on the gauge would have to be eight times as great as in the latter case; if the weight be but half an ounce, the velocity would be sixteen times as great, or 128, because $128 \times \frac{1}{2}$ is equal to 64; and, again, if the weight be $\frac{1}{10}$oz., the corresponding velocity would be 640.

If, then, we take the third shot with the right barrel in the table alluded to, we find that 54 pellets struck the plate, and their combined weight is one-fifth of an ounce. Had the blow from this $\frac{1}{5}$oz. marked 64 force-ounces on the gauge, the velocity would have been five times 64, or 320; but we find by the table that the number marked on the gauge was 124, and the velocity would therefore be five times 124, or 620. A like result is obtained by taking from the table the force per pellet and multiplying by 270; because $\frac{1}{5}$ and $\frac{54}{270}$ are the same, and the force per pellet (2·30) is the 54th part of the 124 force-ounces marked on the gauge.

If shot of any other size were used, the process would be similar, only substituting for 270 the proper number of pellets per ounce. Thus, with No. 5 shot, at 218 pellets to the ounce, 54 pellets would be $\frac{54}{218}$oz.; and if this scored 124 on the gauge, the result would still be 2·30 per pellet, but, being multiplied by 218 instead of 270, the velocity is only 501. Here we have larger shot; and with heavier pellets and lower velocity the same force is indicated as by lighter pellets and higher velocity.

Taking the averages of the thirty-six guns which competed in the 1879 trials, I find that, on this basis, the shooting at 40 yards gives, as the *average velocity of the pellets when striking the target*—for the 12-bores, 592ft.; for the 16-bores, 582ft.; and for the 20-bores, 570ft. per second.

Possibly, it may be asked, how do I account for the wide divergencies which occasionally occur between the velocities of successive shots from the same gun. I can only say that I do not pretend to account for them, any more than to account for diversity in pattern, &c. We simply know that, from some cause or other, guns do not shoot alike with every discharge, whether they are fired at game or at targets; and the report of the trial of 1878 shows that, with successive shots from the same barrel, some penetrated twice as many sheets of papers as others. Various causes would conduce to such a result, and one of them might be this: Supposing that, owing to a defective wad or any other irregularity, the charge of shot opened out immediately after leaving the barrel, instead of keeping in a compact mass, the pellets would then rapidly lose their velocity, in consequence of the increased resistance they would encounter from the air by reason of the greater amount of surface exposed to its action. If we have a spherical leaden ball of one inch in diameter, and the same quantity of the same metal be made into pellets of one-tenth of an inch diameter (which is about the size of No. 6 shot), 100 such pellets would have the same area of surface as the one-inch ball; but the quantity of metal in the ball would make 1000 such pellets, and consequently, if the ball and the pellets were projected with the same initial velocity, and the pellets travelled separately, the aggregate resistance received by the mass of small shot would be ten times that received by the ball; and they would lose speed accordingly. Everybody knows that there is an immense difference in the velocity of a loose charge of shot and the same charge when it "balls," or when it is inclosed in a wire cartridge or a concentrator. So long as the pellets are kept in a compact mass, they expose to the resistance of the atmosphere little more surface than that of a solid ball; but when they spread apart, each receives its amount of individual obstruction, and rapidly loses its force. The object of the skilful gunmaker is to produce, by careful boring, a compact delivery of the shot for as long a distance as is compatible with the purpose for which the gun is required. When, from any little irregularity, this compactness is interfered with, the force of

the pellets at the end of 40 yards is considerably lessened, although the initial velocity of one charge may have been equal to that of another which produced a much better final result. T.

Soon afterwards, Mr. Griffith, in order to ascertain the velocity and striking force of different sizes of shot with various charges of powder, carried out a very extensive series of experiments with shot of seven sizes (Nos. 2 to No. 8 inclusive), using both black and Schultze powder. The following is a summary of the results :

| Shot. | Powder. | Separate Averages. | | | | General Averages. | | | |
|---|---|---|---|---|---|---|---|---|---|
| Size and Charge. | Charge and Description. | Recoil. | Pattern. | Force. | Velocity. | Recoil. | Pattern. | Force. | Velocity. |
| No. 2. 1oz. | 2½drs. C. & H. | 70 | 80 | 4·24 | 847 | 67 | 82 | 4·48 | 852 |
| " " | " Schultze. | 64 | 84 | 4·73 | 856 | | | | |
| " " | 3drs. C. & H. | 82 | 76 | 4·89 | 913 | 78 | 79 | 5·09 | 914 |
| " " | " Schultze. | 75 | 83 | 5·30 | 914 | | | | |
| " " | 3½drs. C. & H. | 90 | 62 | 4·75 | 988 | 86 | 63 | 4·85 | 986 |
| " " | " Schultze. | 83 | 63 | 4·94 | 985 | | | | |
| " 1¼oz. | 3drs. C. & H. | 89 | 95 | 4·54 | 891 | 86 | 93 | 4·58 | 894 |
| " " | " Schultze. | 82 | 91 | 4·62 | 896 | | | | |
| " 1½oz. | 3drs. C. & H. | 92 | 103 | 4·60 | 845 | 89 | 105 | 4·48 | 846 |
| " " | " Schultze. | 85 | 107 | 4·36 | 847 | | | | |
| " 1¾oz. | 3drs. C. & H. | 98 | 106 | 3·91 | 831 | 94 | 112 | 4·17 | 837 |
| " " | " Schultze. | 90 | 117 | 4·43 | 842 | | | | |
| No. 3. 1oz. | 2½drs. C. & H. | 73 | 76 | 3·55 | 818 | 69 | 83 | 3·56 | 814 |
| " " | " Schultze. | 65 | 89 | 3·56 | 810 | | | | |
| " " | 3drs. C. & H. | 84 | 83 | 4·47 | 905 | 80 | 82 | 4·36 | 912 |
| " " | " Schultze. | 76 | 80 | 4·25 | 919 | | | | |
| " " | 3½drs. C. & H. | 91 | 82 | 4·47 | 982 | 87 | 87 | 4·44 | 984 |
| " " | " Schultze. | 82 | 91 | 4·41 | 985 | | | | |
| " 1¼oz. | 3drs. C. & H. | 90 | 97 | 4·28 | 880 | 87 | 102 | 4·18 | 887 |
| " " | " Schultze. | 83 | 106 | 4·08 | 894 | | | | |
| " 1½oz. | 3drs. C. & H. | 94 | 105 | 3·15 | 843 | 91 | 104 | 3·16 | 842 |
| " " | " Schultze. | 87 | 103 | 3·17 | 841 | | | | |
| " 1¾oz. | 3drs. C. & H. | 98 | 114 | 3·14 | 824 | 95 | 115 | 3·14 | 819 |
| " " | " Schultze. | 91 | 115 | 3·13 | 814 | | | | |
| No. 4. 1oz. | 2½drs. C. & H. | 74 | 102 | 2·09 | 807 | 70 | 100 | 2·03 | 808 |
| " " | " Schultze. | 67 | 98 | 1·98 | 809 | | | | |
| " " | 3drs. C. & H. | 85 | 100 | 2·86 | 890 | 81 | 100 | 2·81 | 892 |
| " " | " Schultze. | 76 | 99 | 2·75 | 893 | | | | |

| Shot. | Powder. | Separate Averages. | | | | General Averages. | | | |
|---|---|---|---|---|---|---|---|---|---|
| Size and Charge. | Charge and Description. | Recoil. | Pattern. | Force. | Velocity. | Recoil. | Pattern. | Force. | Velocity. |
| No. 4. 1oz. | 3½drs. C. & H. | 92 | 85 | 3·17 | 965 | 88 | 89 | 3·21 | 964 |
| " " | " Schultze. | 84 | 92 | 3·35 | 963 | | | | |
| " 1¼oz. | 2½drs. C. & H. | 80 | 94 | 2·24 | 797 | 77 | 96 | 2·26 | 796 |
| " " | " Schultze. | 74 | 97 | 2·27 | 795 | | | | |
| " " | 3drs. C. & H. | 89 | 92 | 3·10 | 870 | 87 | 94 | 3·22 | 867 |
| " " | " Schultze. | 84 | 96 | 3·33 | 864 | | | | |
| " 1⅜oz. | 3drs. C. & H. | 93 | 115 | 3·28 | 866 | 89 | 114 | 3·21 | 868 |
| " " | " Schultze. | 84 | 113 | 3·13 | 869 | | | | |
| " 1½oz. | 3drs. C. & H. | 94 | 122 | 2·36 | 832 | 91 | 122 | 2·33 | 835 |
| " " | " Schultze. | 87 | 122 | 2·29 | 837 | | | | |
| " " | 3½drs. C. & H. | 99 | 107 | 2·03 | 832 | 95 | 106 | 2·08 | 831 |
| " " | " Schultze. | 91 | 105 | 2·13 | 830 | | | | |
| No. 5. 1oz. | 2½drs. C. & H. | 75 | 113 | 2·17 | 816 | 71 | 117 | 2·25 | 817 |
| " " | " Schultze. | 67 | 121 | 2·33 | 817 | | | | |
| " " | 3drs. C. & H. | 85 | 118 | 2·38 | 874 | 81 | 114 | 2·32 | 879 |
| " " | " Schultze. | 77 | 109 | 2·25 | 883 | | | | |
| " " | 3½drs. C. & H. | 94 | 108 | 2·61 | 942 | 90 | 108 | 2·40 | 935 |
| " " | " Schultze. | 86 | 107 | 2·28 | 927 | | | | |
| " 1⅛oz. | 3drs. C. & H. | 86 | 148 | 2·41 | 868 | 83 | 148 | 2·52 | 878 |
| " " | " Schultze. | 79 | 147 | 2·63 | 888 | | | | |
| " " | 3½drs. C. & H. | 98 | 125 | 2·16 | 899 | 93 | 126 | 2·27 | 906 |
| " " | " Schultze. | 87 | 126 | 2·37 | 912 | | | | |
| " 1¼oz. | 3drs. C. & H. | 94 | 157 | 1·92 | 849 | 90 | 162 | 1·85 | 846 |
| " " | " Schultze. | 85 | 168 | 1·77 | 843 | | | | |
| " " | 3½drs. C. & H. | 100 | 163 | 2·74 | 873 | 96 | 167 | 2·61 | 882 |
| " " | " Schultze. | 91 | 170 | 2·47 | 891 | | | | |
| " 1⅜oz. | 3drs. C. & H. | 95 | 166 | 1·60 | 837 | 91 | 166 | 1·72 | 837 |
| " " | " Schultze. | 87 | 166 | 1·83 | 836 | | | | |
| No. 6. ⅞oz. | 2½drs. C. & H. | 70 | 129 | 1·59 | 816 | 66 | 131 | 1·71 | 815 |
| " " | " Schultze. | 62 | 133 | 1·84 | 813 | | | | |
| " " | 3drs. C. & H. | 81 | 140 | 2·04 | 883 | 77 | 139 | 2·06 | 880 |
| " " | " Schultze. | 73 | 137 | 2·08 | 877 | | | | |
| " " | 3½drs. C. & H. | 91 | 122 | 1·96 | 880 | 86 | 138 | 2·02 | 913 |
| " " | " Schultze. | 80 | 155 | 2·08 | 913 | | | | |
| " 1oz. | 2½drs. C. & H. | 76 | 100 | 1·57 | 759 | 73 | 162 | 1·65 | 770 |
| " " | " Schultze. | 69 | 163 | 1·73 | 781 | | | | |
| " " | 3drs. C. & H. | 86 | 147 | 1·88 | 860 | 83 | 153 | 1·87 | 859 |
| " " | " Schultze. | 79 | 159 | 1·87 | 858 | | | | |
| " " | 3½drs. C. & H. | 95 | 123 | 1·87 | 900 | 91 | 128 | 1·88 | 903 |
| " " | " Schultze. | 87 | 153 | 1·88 | 905 | | | | |
| " 1⅛oz. | 3drs. C. & H. | 88 | 187 | 1·84 | 827 | 84 | 179 | 1·89 | 838 |
| " " | " Schultze. | 80 | 170 | 1·93 | 848 | | | | |
| " " | 3½drs. C. & H. | 95 | 172 | 1·85 | 909 | 92 | 175 | 1·90 | 912 |
| " " | " Schultze. | 88 | 177 | 1·94 | 915 | | | | |

| Shot. | Powder. | Separate Averages. | | | | General Averages. | | | |
|---|---|---|---|---|---|---|---|---|---|
| Size and Charge. | Charge and Description. | Recoil. | Pattern. | Force. | Velocity. | Recoil. | Pattern. | Force. | Velocity. |
| **No. 6.** 1¼oz. | 3drs. C. & H. | 94 | 188 | 1·64 | 849 | 90 | 198 | 1·75 | 845 |
| ,, ,, | ,, Schultze. | 86 | 207 | 1·85 | 841 | | | | |
| ,, ,, | 3½drs. C. & H. | 99 | 177 | 1·72 | 852 | 94 | 183 | 1·75 | 858 |
| ,, ,, | ,, Schultze. | 89 | 189 | 1·77 | 863 | | | | |
| **No. 7.** ¾oz. | 3drs. C. & H. | 79 | 141 | 1·34 | 864 | 74 | 153 | 1·44 | 859 |
| ,, ,, | ,, Schultze. | 68 | 164 | 1·53 | 853 | | | | |
| ,, ,, | 3½drs. C. & H. | 85 | 147 | 1·35 | 976 | 80 | 150 | 1·39 | 974 |
| ,, ,, | ,, Schultze. | 74 | 152 | 1·42 | 972 | | | | |
| ,, ⅞oz. | 3drs. C. & H. | 79 | 147 | 1·46 | 862 | 74 | 157 | 1·48 | 867 |
| ,, ,, | ,, Schultze. | 69 | 166 | 1·50 | 871 | | | | |
| ,, ,, | 3½drs. C. & H. | 89 | 142 | 1·23 | 894 | 85 | 144 | 1·33 | 902 |
| ,, ,, | ,, Schultze. | 80 | 146 | 1·43 | 910 | | | | |
| ,, 1oz. | 2½drs. C. & H. | 76 | 198 | 1·06 | 761 | 73 | 212 | 1·08 | 764 |
| ,, ,, | ,, Schultze. | 69 | 226 | 1·09 | 766 | | | | |
| ,, ,, | 3drs. C. & H. | 86 | 211 | 1·23 | 829 | 82 | 213 | 1·22 | 836 |
| ,, ,, | ,, Schultze. | 78 | 215 | 1·20 | 842 | | | | |
| ,, ,, | 3½drs. C. & H. | 95 | 174 | 1·16 | 895 | 91 | 180 | 1·24 | 898 |
| ,, ,, | ,, Schultze. | 87 | 185 | 1·31 | 901 | | | | |
| ,, 1⅛oz. | 3drs. C. & H. | 90 | 206 | 1·09 | 823 | 86 | 220 | 1·15 | 822 |
| ,, ,, | ,, Schultze. | 81 | 233 | 1·20 | 820 | | | | |
| ,, ,, | 3½drs. C. & H. | 98 | 190 | 1·22 | 884 | 93 | 189 | 1·24 | 889 |
| ,, ,, | ,, Schultze. | 88 | 188 | 1·25 | 894 | | | | |
| **No. 8.** ⅝oz. | 3drs. C. & H. | 70 | 157 | 1·16 | 844 | 62 | 161 | 1·16 | 840 |
| ,, ,, | ,, Schultze. | 54 | 164 | 1·16 | 836 | | | | |
| ,, ,, | 3½drs. C. & H. | 79 | 143 | 1·06 | 938 | 73 | 153 | 1·03 | 941 |
| ,, ,, | ,, Schultze. | 67 | 162 | 0·99 | 943 | | | | |
| ,, ¾oz. | 3drs. C. & H. | 78 | 161 | 0·96 | 835 | 71 | 169 | 1·03 | 835 |
| ,, ,, | ,, Schultze. | 63 | 176 | 1·09 | 835 | | | | |
| ,, ,, | 3½drs. C. & H. | 84 | 161 | 1·00 | 919 | 78 | 172 | 1·02 | 928 |
| ,, ,, | ,, Schultze. | 72 | 183 | 1·03 | 937 | | | | |
| ,, ⅞oz. | 3drs. C. & H. | 83 | 250 | 0·92 | 844 | 79 | 255 | 0·95 | 861 |
| ,, ,, | ,, Schultze. | 74 | 259 | 0·97 | 878 | | | | |
| ,, ,, | 3½drs. C. & H. | 93 | 206 | 0·93 | 905 | 88 | 212 | 0·94 | 898 |
| ,, ,, | ,, Schultze. | 82 | 218 | 0·94 | 892 | | | | |
| ,, 1oz. | 2½drs. C. & H. | 76 | 259 | 0·82 | 776 | 74 | 271 | 0·83 | 784 |
| ,, ,, | ,, Schultze. | 71 | 284 | 0·84 | 791 | | | | |
| ,, ,, | 3drs. C. & H. | 86 | 246 | 0·73 | 816 | 83 | 276 | 0·81 | 820 |
| ,, ,, | ,, Schultze. | 79 | 305 | 0·89 | 823 | | | | |
| ,, ,, | 3½drs. C. & H. | 96 | 266 | 0·81 | 828 | 92 | 258 | 0·85 | 830 |
| ,, ,, | ,, Schultze. | 88 | 250 | 0·88 | 831 | | | | |
| ,, 1⅛oz. | 3drs. C. & H. | 92 | 319 | 0·72 | 784 | 87 | 318 | 0·78 | 787 |
| ,, ,, | ,, Schultze. | 82 | 316 | 0·84 | 790 | | | | |
| ,, ,, | 3½drs. C. & H. | 99 | 276 | 0·80 | 855 | 94 | 271 | 0·81 | 865 |
| ,, ,, | ,, Schultze. | 89 | 266 | 0·81 | 874 | | | | |

As in his previous experiment, already recorded (page 40), Mr. Griffith took the mean velocity of the fastest pellets in the charge by the Boulengé chronograph, while the striking force of the charge was recorded by the *Field* force gauge. The full details are given in the *Field* of July 26, 1879, but they are so elaborate that it was not desirable to reprint them here in full, and consequently the foregoing summary has been compiled, giving only the average of each series of shots.

Mr. Griffith gave the following particulars respecting the experiments, the results of which are summarised above:

The results sent are with all sizes, from Nos. 2 to 8 chilled; with each size 1oz. has been tried, with three charges of powder, 2½, 3, and 3½ drachms, to form a sort of standard for comparison all through: then larger charges of the larger shot and smaller ones of the smaller shot, so as to include most loads used in shooting. Three shots of each were recorded, to insure accuracy; and during the carrying out of the experiments, I threw out and re-tried any particular shot which seemed to give unreliable results.

The samples of shot were chosen as having a specific gravity as nearly alike as possible. The slight variation follows steadily the size of shot, as follows:

| | |
|---|---|
| No. 2 shot gave sp. gr. 10·911 | No. 6 shot gave sp. gr. 11·001 |
| No. 3 ,, ,, 10·953 | No. 7 ,, ,, 11·010 |
| No. 4 ,, ,, 10·980 | No. 8 ,, ,, 11·011 |
| No. 5 ,, ,, 10·988 | |

The average diameters of the pellets I find to be:

| | |
|---|---|
| No. 2 shot ......... ·138 inch. | No. 6 shot ......... ·103 inch. |
| No. 3 ,, ......... ·129 ,, | No. 7 ,, ......... ·094 ,, |
| No. 4 ,, ......... ·120 ,, | No. 8 ,, ......... ·086 ,, |
| No. 5 ,, ......... ·112 ,, | |

The gun used by me in carrying out the experiments weighs 7lb. 10oz. Having come to the conclusion, from previous experiments, that a heavy charge does not give such good results when fired from a light gun as from a heavy gun, and wanting to get the best results all round, I used the heaviest one to hand.

I have calculated from the whole series that the following averages show the comparative results with 1oz. shot of different sizes:

| Size of Shot. | Gun Recoil. | Pattern. | Penetration. | Velocity. |
|---|---|---|---|---|
| No. 2 | 77 | 75 | 4·81 | 917 |
| No. 3 | 79 | 84 | 4·12 | 903 |
| No. 4 | 80 | 96 | 2·68 | 888 |
| No. 5 | 81 | 113 | 2·32 | 875 |
| No. 6 | 82 | 148 | 1·80 | 844 |
| No. 7 | 82 | 203 | 1·18 | 833 |
| No. 8 | 83 | 268 | 0·83 | 811 |

From these averages it will be seen that the gun recoil and pattern increase steadily with size (number) of shot, while penetration and velocity decrease.

But the velocity of the small shot does not differ so much from that of the large shot as might have been expected; evidently, at 40 yards range, the resistance of the air has not told very much against the small shot, or else the small shot must start with a higher velocity than do the larger shot, and thus reach the 40 yards target not much behind the larger ones, although undoubtedly, weight for weight, the charge of small has to encounter much more atmospheric resistance than the large. If so, there is a point within the 40 yards range where the large overtake the small and pass them.

If mean velocity, then, be the real test of penetration, there must be a point nearer than 40 yards where the smaller shot have a greater or as great a penetrative power as the larger sizes.

The mean velocity of the small shot might have been increased by the charge of small keeping together longer than the charge of large. To see whether this were the case, I shot some of the loads through a series of screens placed at 5, 10, and 15 yards from the muzzle of the gun, and measured the diameter of the pattern marked on each screen with various charges of powder and different-sized shot. From appended results, it appears there is very little difference in the way the charge breaks up with different sizes when using 3drs. powder; with 3½drs. the charge breaks up decidedly more; and with 2½drs. the charge is not so concentrated, and gives greater diameter than with 3drs.

I have had no time to go deeply into this part of the question, but think probably experiments conducted with recording screens might give us useful information, as to the whereabouts of the shot during the flight, and where it begins most to scatter.

DIAMETER OF PATTERN IN INCHES.

| Charge Powder. | Size and Weight Shot. | At 5 Yards. | At 10 Yards. | At 15 Yards. | Producing pattern. on 30in. target of |
|---|---|---|---|---|---|
| 2½drs. | 1oz. No. 2 | 4 | 9 | 14 | 72 |
| 2½drs. | 1oz. No. 5 | 4 | 9 | 13 | 101 |
| 2½drs. | 1oz. No. 8 | 4½ | 10 | 14 | 268 |
| 3 drs. | 1oz. No. 2 | 3½ | 7 | 10 | 80 |
| 3 drs. | 1oz. No. 3 | 3 | 6 | 9 | 83 |
| 3 drs. | 1oz. No. 4 | 4 | 6 | 10 | 95 |
| 3 drs. | 1oz. No. 5 | 4 | 6½ | 11 | 118 |
| 3 drs. | 1oz. No. 6 | 4½ | 7 | 11 | 156 |
| 3 drs. | 1oz. No. 7 | 4 | 7 | 12 | 201 |
| 3 drs. | 1oz. No. 8 | 4 | 6½ | 11 | 308 |
| 3½drs. | 1oz. No. 2 | 5 | 9 | 14 | 68 |
| 3½drs. | 1oz. No. 5 | 5 | 9 | 13 | 100 |
| 3½drs. | 1oz. No. 8 | 7 | 11 | 15 | 243 |

I am more than ever convinced that too heavy charges of powder reduce the real penetration rather than increase it; these experiments show that, although the mean velocity is, as a rule, increased by adding ½dr. powder, the penetration, taken by the force-gauge, is not always increased, and on looking through experiments carried out formerly with Pettitt's pads, I find as an average on many shots the following:

DISTANCE 40 YARDS.

| Charge Powder. | Shot No. 2. | Shot No. 3. | Shot No. 4. | Shot No. 5. | Shot No. 6. | Shot No. 7. | Shot No. 8. |
|---|---|---|---|---|---|---|---|
| 2½ drs. | 38 | 35 | 30 | 24 | 18 | 16 | 13 Sheets of |
| 3 drs. | 46 | 40 | 35 | 32 | 26 | 22 | 17 Pettitt's |
| 3½ drs. | 44 | 40 | 37 | 30 | 26 | 21 | 16 Pads. |

Showing that an increased ½dr. beyond 3drs. did not produce corresponding increase in penetration.

But wild shots from too large charge of powder, or from other cause, are more punished by the force-gauge than by pads, and rightly; a shot that does not deliver the charge simultaneously at the target, or which sends it with sufficient variation in velocity of pattern to cause it to lose penetration on the gauge—be the fault owing to gun or load—is a bad shot, and deserves to be penalised. Provided the pellets travel and strike simultaneously, the gauge records increased penetration in different loads with certainty.

I may mention that I have tried a gauge with a target large enough to collect the whole 30in. pattern, but the results were

unreliable. However, a 10in. target which collects 50 pellets out of a pattern of 200, must furnish every required information for practical work. In striking the averages from the tables, I have omitted fractions for simplicity, putting the nearest whole number.

R. W. S. GRIFFITH.

A very lengthy analysis of the facts contained in Mr. Griffith's elaborate experiments appeared in subsequent numbers of the *Field*, from which we give the following extracts:

Probably the first thing which most persons would seek to ascertain in looking over Mr. Griffith's tables would be, what charge produced the best results with the different sizes of shot. Obviously, however, one cannot put the records of different varieties of shot into direct comparison, for the small sizes would greatly outnumber the large as regards pattern, while they would appear insignificant as regards pellet-force. I shall therefore, in addition to the number of pellets in the pattern, state what percentage they form of the charge of shot used: and I shall turn the pellet-force of the tables into velocity, on the assumption that the average force of the pellets that strike the gauge is recorded with sufficiently approximate accuracy to answer this purpose. The percentage of the charge will thus show the comparative pattern made by different sizes of shot, and the final velocity will indicate their comparative force; for, with equal velocity, the blow given by shot of different sizes will be proportionate to their weight. As the No. 5 pellet used in this trial weighs twice as much as the No. 8 pellet, the former will strike twice as heavy a blow as the latter, when their speed is the same, while its proportionate pattern would be only half as great; and as a No. 2 pellet is very nearly four times as heavy as one of No. 8, its force would be about four times more and the pattern about four times less than the small-sized shot.

With this preliminary, I now proceed to give the results shown by Mr. Griffith's averages from the two kinds of powder with each size of shot; for to take each powder separately would unduly lengthen and complicate the comparison.

BEST RESULTS, FROM AVERAGE OF BOTH POWDERS.

No. 2 SHOT.—116 PELLETS TO THE OUNCE.

| | Pattern. | Force-gauge Record. |
|---|---|---|
| 3 drs. and 1 oz. ... | 79, or 68 per cent. ... | 5·09, or 591ft. final velocity. |
| 2½ " 1 oz. ... | 82, or 71 " ... | 4·48, or 520ft. " |
| 3½ " 1 oz. ... | 63, or 54 " ... | 4·85, or 563ft. " |
| 3 " 1⅛oz. ... | 93, or 64 " ... | 4·58, or 531ft. " |

With 3drs. powder and 1oz. shot the best result was produced. By increasing the powder half a drachm, there was a falling off of about 14 per cent. in pattern and 5 per cent. in pellet-force. Increased charges of shot produced diminished force, 1¼oz. with 3drs. showing only the same velocity as 1oz. with 2½drs., while with 1¾oz. there was a further considerable decrease. Numerically, of course, the pattern was increased, but the percentage was less than with some of the smaller charges.

No. 3.—139 Pellets to the Ounce.

| | Pattern. | Force-gauge Record. |
|---|---|---|
| 3½drs. and 1 oz. | 87, or 63 per cent. | 4·44, or 617ft. final velocity. |
| 3 „ 1 oz. | 82, or 59 „ | 4·36, or 606ft. „ |
| 3 „ 1¼oz. | 102, or 59 „ | 4·18, or 581ft. „ |
| 2½ „ 1 oz. | 83, or 60 „ | 3·56, or 495ft. „ |

With this size the largest charge of powder made the best record with 1oz. of shot. With 2½drs. and 1oz., both powders gave poor results; and 3drs. did even worse with anything over 1¼oz.

No. 4.—178 Pellets to the Ounce.

| | Pattern. | Force-gauge Record. |
|---|---|---|
| 3½drs. and 1 oz. | 89, or 50 per cent. | 3·26, or 580ft. final velocity. |
| 3 „ 1¼oz. | 94, or 42 „ | 3·22, or 573ft. „ |
| 3 „ 1⅜oz. | 114, or 47 „ | 3·21, or 571ft. „ |
| 3½ „ 1⅜oz. | 104, or 43 „ | 3·19, or 568ft. „ |

Here again 3½drs. of powder did best with 1oz. of shot. With 3drs. and 1oz. the results were very poor; but when the shot was increased to 1¼oz., and also to 1⅜oz., the charge of powder remaining as before (3drs.), the force was increased instead of diminished. Altogether, the performance of No. 4 was strangely irregular in some respects, yet remarkable for the comparative closeness with which the two kinds of powder kept together during these vagaries. For example:

| | Pattern. | Force. | Chronograph. |
|---|---|---|---|
| 3drs. C. & H., with 1⅜oz. shot | 115 | 3·28 | 866 mean velocity. |
| „ Schultze, „ „ | 113 | 3·13 | 869 „ |
| 3drs. C. & H., with 1½oz. shot | 122 | 2·36 | 832 „ |
| „ Schultze, „ „ | 122 | 2·29 | 837 „ |

It will thus be seen that, with an increase of only one-eighth of an ounce of shot, the pellet-force fell off simultaneously with both powders more than 25 per cent.

No. 5.—219 Pellets to the Ounce.

| | Pattern. | Force-gauge Record. |
|---|---|---|
| 3½drs. and 1¼oz. | 167, or 61 per cent. | 2·61, or 572ft. final velocity. |
| 3 „ 1⅛oz. | 148, or 60 „ | 2·52, or 552ft. „ |
| 3½ „ 1 oz. | 108, or 49 „ | 2·40, or 526ft. „ |
| 3 „ 1 oz. | 114, or 52 „ | 2·32, or 508ft. „ |

No. 5 did its best with a large charge of shot as well as of powder. With $3\frac{1}{2}$drs. and $1\frac{1}{4}$oz. the black powder had much the best as regards force, but with 3drs. and $1\frac{1}{8}$oz. the tables were turned, the wood powder now showing as much increase of force as the black showed diminution. Hence the averages of the two charges vary comparatively little, although there were such wide divergences between the two powders.

No. 6.—270 Pellets to the Ounce.

| | | Pattern. | | Force-gauge Record. |
|---|---|---|---|---|
| 3 drs. and $\frac{7}{8}$oz. | ... | 139, or 59 per cent. | ... | 2·06, or 556ft. final velocity. |
| $3\frac{1}{2}$ „ $\frac{7}{8}$oz. | ... | 138, or 58 „ | ... | 2·02, or 545ft. „ |
| 3 „ 1 oz. | ... | 153, or 57 „ | ... | 1·87, or 505ft. „ |
| $3\frac{1}{2}$ „ 1 oz. | ... | 138, or 51 „ | ... | 1·88, or 508ft. „ |
| 3 „ $1\frac{1}{8}$oz. | ... | 179, or 59 „ | ... | 1·89, or 510ft. „ |
| $3\frac{1}{2}$ „ $1\frac{1}{8}$oz. | ... | 175, or 58 „ | ... | 1·90, or 513ft. „ |

No. 6 made its best record of force with $\frac{7}{8}$oz. of shot, there being but little to choose between the averages of 3drs. and $3\frac{1}{2}$drs., either as regards pattern or force, but 3drs. having slightly the advantage. With larger charges of shot, the force always diminished, while the pattern was not always increased. Thus, with $3\frac{1}{2}$drs., 1oz. gave exactly the same pattern (138) as $\frac{7}{8}$oz., while the final velocity was nearly 40ft. less with the larger quantity of shot; and with $1\frac{1}{8}$oz. of shot, it will be seen that pattern and force were almost exactly the same with 3drs. as with $3\frac{1}{2}$drs.

No. 7.—346 Pellets to the Ounce.

| | | Pattern. | | Force-gauge Record. |
|---|---|---|---|---|
| 3 drs. and $\frac{3}{4}$oz. | ... | 153, or 59 per cent. | ... | 1·44, or 498ft. final velocity. |
| $3\frac{1}{2}$ „ $\frac{3}{4}$oz. | ... | 150, or 58 „ | ... | 1·34, or 481ft. „ |
| 3 „ $\frac{7}{8}$oz. | ... | 157, or 52 „ | ... | 1·48, or 512ft. „ |
| 3 „ 1 oz. | ... | 213, or 62 „ | ... | 1·22, or 422ft. „ |
| $3\frac{1}{2}$ „ 1 oz. | ... | 180, or 52 „ | ... | 1·24, or 429ft. „ |
| $3\frac{1}{2}$ „ $1\frac{1}{8}$oz. | ... | 189, or 48 „ | ... | 1·24, or 429ft. „ |

With No. 7, also, $\frac{7}{8}$oz. made the best average as regards pellet-force with 3drs. of powder; with $3\frac{1}{2}$drs. there was a falling off; and with increased charges of shot the larger pattern was accompanied by still greater deterioration in force.

No. 8.—438 Pellets to the Ounce.

| | | Pattern. | | Force-gauge Record. |
|---|---|---|---|---|
| 3 drs. and $\frac{5}{8}$oz. | ... | 161, or 59 per cent. | ... | 1·16, or 508ft. final velocity. |
| $3\frac{1}{2}$ „ $\frac{5}{8}$oz. | ... | 153, or 56 „ | ... | 1·03, or 451ft. „ |
| 3 „ $\frac{3}{4}$oz. | ... | 169, or 52 „ | ... | 1·03, or 451ft. „ |
| $3\frac{1}{2}$ „ $\frac{3}{4}$oz. | ... | 172, or 53 „ | ... | 1·02, or 447ft. „ |
| 3 „ $\frac{7}{8}$oz. | ... | 255, or 67 „ | ... | 0·95, or 416ft. „ |
| $3\frac{1}{2}$ „ $\frac{7}{8}$oz. | ... | 212, or 55 „ | ... | 0·94, or 412ft. „ |

The smallest charge ($\frac{5}{8}$oz.) gave the highest force with 3drs.;

and there was a falling off of force when either powder or shot was increased in quantity.

Now, in examining these records, valuable as the facts are, we must not proceed to draw too many general conclusions from them. They are but the results obtained from one gun; and a different gun would no doubt produce a variation in some respects, though there would probably be a similarity in others. We find, as might be anticipated, that with a diminution in weight of the pellets there is a gradual diminution in velocity—whether it be the "mean," as taken by the chronograph, or the "final" as indicated by the force-gauge. A particular gun may do better with one size of shot than with another, and the regularity of the gradation may thus be more or less interfered with, but the rule remains the same. The present gun does better with No. 3 and No. 5 than with Nos. 2 and 4; and it was to ascertain whether this was caused by the gun or the shot that I asked Mr. Griffith for information as to the specific gravity of the various sizes. The particulars which he obligingly furnished show that the variation did not depend upon any such difference in the pellets; and it may therefore be concluded that there is something in the boring of the gun that suits the one size rather than the other. If we drop shot of different dimensions into cartridge cases (or, better still, into glass tubes, where we can see successive layers), we shall find, particularly with the largest samples, that some of them "chamber" or fit the bore much better than others, and that, whereas some of them lie regularly, one over another, in successive layers, others "ride up" and leave gaps between them. Where there is such difference in solidity of packing, it is hardly to be supposed that all would travel with equal accuracy on leaving the gun; and as a size which does not adapt itself well to one bore will fit comfortably in another, we may see a reason for a 20-bore gun shooting No. 4 shot better than a 12-bore, or *vice versâ*. Besides which, shot of the same number differ considerably in size, and guns of ostensibly the same gauge vary somewhat in the diameter of the bore, even when the chamber is the same. From the latter cause, it may happen that shot which chamber evenly in a cartridge case may be more jammed and distorted in the barrel of one gun than in that of another; and as the average diameter of the No. 4 pellets used by Mr. Griffith was ·120in., while that of the No. 4 used in the Editor's experiments (page 70 *et seq.*) was only ·114in., it can readily be seen that two samples of the same

nominal size might not adapt themselves equally well to the same gun.

The relative "final" velocities of the various sizes of shot, as exhibited by the force-gauge with those charges which produced the greatest force per pellet, were as follows—the two powders being given separately, instead of the average alone, as in the foregoing tables.

| | No. 2. | No. 3. | No. 4. | No. 5. | No. 6. | No. 7. | No. 8. |
|---|---|---|---|---|---|---|---|
| C. & H. ... | 567 | 621 | 564 | 600 | 551 | 505 | 508 |
| Schultze ... | 614 | 612 | 596 | 541 | 562 | 519 | 508 |
| Average | 591 | 617 | 580 | 571 | 557 | 512 | 508 |

The "mean" velocities of the *fastest* pellets in the same charges, as taken by the chronograph, were as follows:

| | No. 2. | No. 3. | No. 4. | No. 5. | No. 6. | No. 7. | No. 8. |
|---|---|---|---|---|---|---|---|
| C. & H. ... | 913 | 982 | 965 | 873 | 883 | 862 | 844 |
| Schultze ... | 914 | 985 | 963 | 891 | 877 | 871 | 836 |
| Average | 914 | 984 | 964 | 882 | 880 | 867 | 840 |

In these instances the charges varied; but with equal charges (3drs. and 1oz.), the chronograph gradations are more regular, as will be seen by the annexed figures:

| | No 2. | No. 3. | No. 4. | No. 5. | No. 6. | No. 7. | No. 8. |
|---|---|---|---|---|---|---|---|
| C. & H. ... | 913 | 905 | 890 | 874 | 860 | 829 | 816 |
| Schultze ... | 914 | 919 | 893 | 883 | 858 | 842 | 823 |
| Average | 914 | 912 | 892 | 879 | 859 | 836 | 820 |

But the striking force descends with less regularity, and falls off with greater rapidity in the light pellets than in the heavy. Thus, with the charge just mentioned, the force gauge indicates these final velocities:

| | No. 2. | No. 3. | No. 4. | No. 5. | No. 6. | No. 7. | No. 8. |
|---|---|---|---|---|---|---|---|
| C. & H. ... | 567 | 621 | 509 | 521 | 507 | 426 | 320 |
| Schultze ... | 615 | 591 | 490 | 493 | 505 | 415 | 390 |
| Average | 591 | 606 | 500 | 507 | 506 | 421 | 355 |

At first sight these last may appear to conflict with the previous figures, and to show a much greater comparative descent in the final velocities than in the mean velocities; but it must not be forgotten that the mean is made up of two extremes, and, although we do not know the initial velocities, there is not likely to be any very considerable difference between the starting speed of the pellets propelled from the same gun by the same charge of powder;

and consequently, if the mean velocity falls off 100ft., the final velocity must fall off nearly double that amount, though not quite double, because the rate of decrease varies with the velocity and with the size of the pellets. Mr. Griffith described in his first paper (page 46) the experiment he carried out to ascertain the difference in speed of the fastest and the slowest pellets of the same charge of No. 6 shot from a cylinder gun, when they struck the target at 40 yards; and the difference of their mean velocities, as ascertained by the chronograph, he found to be about 140ft. per second. As these pellets must have had the same initial velocity, the *mean* must have been reduced by the falling off at the other end; and this would indicate (with the particular gun and charge then used) a difference nearly twice as great as that shown by the chronograph—or somewhere about 250ft. variation in the velocity of the pellets of the same charge after travelling 40 yards. The smaller the pellets the greater this difference becomes.

The gun used by Mr. Griffith in this last series of experiments was a 12-bore of 7lb. 10oz., and apparently not a full choke, though giving a much larger pattern than a cylinder. With this I will put in comparison, with charges as nearly alike as possible, the performances of various other guns, viz., (1) the choke-bore used in Mr. Griffith's previous experiments, the weight of which is not stated; (2) the 12-bore gun of 7lb. 4oz. used by the Editor in his trial of Nos. 4, 5, and 6 shot; and (3) the average of the dozen 12-bore guns shot at the trials of May, 1879, which varied in weight from 6lb. 9oz. to 7lb. 4oz., and averaged 7lb. 0½oz. As black powder only was used in the trials of May and June, I give only the black powder results with Mr. Griffith's guns.

No. 6 Shot (1⅛oz. throughout).

| | Pattern. | Force-gauge Record. | Chronograph. |
|---|---|---|---|
| Mr. Griffith's 7lb. 10oz. gun (3drs.) | 187 ... | 1·84, or 497ft. velocity ... | 827 vel. |
| „ ditto (3¼drs.) | 172 ... | 1·85, or 500ft. „ ... | 909 „ |
| „ choke-bore (3drs.) | 191 ... | 2·12, or 572ft. „ ... | 861 „ |
| „ ditto (3½drs.) | 161 ... | 1·92, or 518ft. „ ... | 913 „ |
| Gun of No. 4, 5, 6 trial (3drs.) ... | 197 ... | 2·34, or 632ft. „ ... | — |
| Twelve of 1879 trials (3 or 3¼drs.) | 195 ... | 2·19, or 591ft. „ ... | — |
| | No. 5 Shot. | | |
| 7lb. 10oz. gun (with 1⅛oz. & 3drs.) | 148 ... | 2·41, or 528ft. „ ... | 868 „ |
| ditto (with 1¼oz. & 3¼drs.) | 163 ... | 2·74, or 610ft. „ ... | 873 „ |
| 4, 5, 6 gun (with 1⅛oz. & 3drs.) ... | 165 ... | 2·69, or 590ft. „ ... | — |

It will be observed that the 7lb. 10oz. gun used in Mr. Griffith's experiments makes a comparatively poor show with No. 6 shot—a

size with which it evidently does not do its best. With No. 5 it exhibits a vast improvement; for with $1\frac{1}{4}$oz. and $3\frac{1}{2}$drs. its force per pellet was higher than that given by the capital gun used in the Editor's No. 4, 5, and 6 trial. The latter gun, on the other hand, shoots best with No. 6, with which size its pellet-force was higher than that of all the guns except one shot at the 1879 trials (and that one not the winner), for its record was 2·34, or 632ft. final velocity, which, as shown above, fell off to 590ft. when an equal charge of No. 5 was substituted for No. 6. I make no attempt to compare the Editor's No. 4 results with those of Mr. Griffith, as the pellets, though nominally the same, differed so greatly in size, weight, and specific gravity as to put comparison out of the question. T.

With regard to the relative penetration of the different pellets used in these trials, the same writer says:

Penetration seems so simple a matter, when one merely considers the number of sheets of paper pierced by shot of the same size—and comparisons of the performances of different guns are so readily made by this means—that we are apt to overlook the fact that it is really a very complex affair, and that, as soon as we alter the sample of shot, we so materially interfere with the conditions as to render comparison by no means easy.

The number of sheets penetrated does not indicate the force of the blow, unless we take into consideration also the size and weight of the pellet. We may ascertain that in the ounce of one size of shot there are twice as many pellets as there are in another, and may know that the larger pellet will strike twice as heavy a blow as the smaller when they are travelling with equal velocities; but if we jump to the conclusion that the small pellet strikes as hard a blow as the large because it penetrates as many sheets of paper, or if we imagine that the two would, with equal velocity, penetrate an equal number of sheets, we shall be very much out in our reckoning.

Penetration is only of value to the sportsman so far as it represents a deadly blow; he does not want to produce indirect destruction, or to cause a lingering death—his object is to destroy life instantaneously. A No. 8 pellet, even if it possessed sufficient velocity to drill completely through a blackcock, would not knock over the bird with the same certainty as No. 5, which produces a greater shock through its increased dimensions. But of course we

must suit our shot to our game. It is not advantageous to kill snipe with No. 2, any more than to crack nuts with a steam hammer.

In trials of monster guns, in which comparisons are made between the weights and velocities of projectiles fired from Krupp breech-loaders and Woolwich Infants, their respective "energy" is given in foot-tons; and it may give a clearer notion of the mechanical power of our pellets if I make use of the same principle, and, taking the different sizes of shot employed by Mr. Griffith in his experiments, show the energy, or working power, of each pellet in foot-pounds, at different velocities. As the characteristics will be more marked with wide than with small differences of velocity, I will take four, at 100 feet apart:

ENERGY OF SHOT OF DIFFERENT SIZES AT DIFFERENT VELOCITIES, SHOWN IN FOOT-POUNDS.

| Velocity. | No. 2. ft.-lbs. | No. 3. ft.-lbs. | No. 4. ft.-lbs. | No. 5. ft.-lbs. | No. 6. ft.-lbs. | No. 7. ft.-lbs. | No. 8. ft.-lbs. |
|---|---|---|---|---|---|---|---|
| 700 feet | 4·13 | 3·44 | 2·69 | 2·18 | 1·77 | 1·38 | 1·09 |
| 600 " | 3·03 | 2·53 | 1·98 | 1·60 | 1·30 | 1·02 | 0·80 |
| 500 " | 2·10 | 1·76 | 1·37 | 1·12 | 0·90 | 0·71 | 0·56 |
| 400 " | 1·35 | 1·12 | 0·88 | 0·72 | 0·59 | 0·45 | 0·36 |

Here it will be seen that, with equal velocities, the energy is proportionate to the weight of the pellet—No. 5's energy and weight being double that of No. 8, and No. 2's nearly double that of No. 5; but the number of pellets to the ounce do not increase in a regular way, and consequently there is a rather larger gap between No. 3 and No. 4 than occurs before or after.

With difference of speed, the energy of each pellet differs in proportion to the square of its velocity, so that double the speed gives four times the energy, while with $1\frac{1}{2}$ times the velocity the energy is $2\frac{1}{4}$ times as great, and so on; any reduction in difference of speed thus reducing rapidly the difference in energy, and *vice versâ*. Hence, the above table shows that, from 400ft. to 600ft., the increase in velocity being one-half, the energy (say of No. 4) increases from 0·88 to 1·98 foot-pounds—that is to say, it is $2\frac{1}{4}$ times as great, or shows an increase of 125 per cent.; whereas from 500ft. to 600ft., the increase of velocity being only one-fifth, the increase of energy falls to 45 per cent.; and with so small a difference as between 600ft. and 610ft., the increase of energy would be but 3 per cent.

In addition to the circumstances here mentioned as affecting the increase or diminution of energy in the shot, the penetration

varies according to the size of the pellet, as compared with its weight.

If two shots of the same diameter but different density, moving with equal velocity, hit a substance which is not so hard as to produce distortion, the heavier of the two will show most penetration; if the two are of equal weight but different diameter, the smaller will penetrate furthest, as there is a less amount of surface to resist entry. In the former case the penetration is proportionate to the weight, and in the latter it is in inverse proportion to the square of the diameter. With shots of like density and at equal velocities, the largest will show most penetration, because they have a smaller surface in proportion to their weight.

Taking the seven sizes of shot used by Mr. Griffith, and allowing for their respective densities, I find that their comparative penetration, with the same velocities as in the previous table, would be as follows—supposing the paper to be of such substance that ten sheets would be penetrated by a No. 8 pellet with 400ft. velocity, and that the pads were so homogeneous as to permit of equality of penetration. I give the nearest number of sheets, omitting fractions:

COMPARATIVE PENETRATION OF SHOT OF DIFFERENT SIZES AT DIFFERENT VELOCITIES.

| Velocity. | No. 2. Sheets. | No. 3. Sheets. | No. 4. Sheets. | No. 5. Sheets. | No. 6. Sheets. | No. 7. Sheets. | No. 8. Sheets. |
|---|---|---|---|---|---|---|---|
| 700 feet... | 47 | 45 | 41 | 39 | 36 | 33 | 31 |
| 600 „ ... | 35 | 33 | 30 | 28 | 26 | 24 | 23 |
| 500 „ ... | 24 | 23 | 21 | 20 | 18 | 17 | 16 |
| 400 „ ... | 16 | 15 | 13 | 13 | 12 | 11 | 10 |

It will be observed, as may be expected, that, taking each size separately, its penetration increases with its speed, and it will be found that it does so in the same ratio as in the preceding table, 500ft. giving about one half more than 400ft., while 600ft. gives $2\frac{1}{4}$ times as much as 400ft., and 700ft. about three times as much as 400ft.

Penetration will likewise be seen to augment steadily with the size of the shot; but in this case the increase of penetration is not in the same ratio as the increase of mechanical force, by reason of the obstruction due to the larger surface of the pellet. Hence No. 5, with double the energy of No. 8, only raises the penetration from 16 to 20 sheets; while No. 2 brings it up to no more than 24—the velocity being the same in each case, viz., 500ft. By comparing penetration with energy we may see why it is that No. 8,

even although it should have nearly as much penetration as No. 6, will not be equally effective at grouse or pigeons. It has sufficient power to pierce the plumage and kill snipe well enough; but with larger birds, although a lucky pellet may strike a vital part, it is more apt to wound than to produce instantaneous death, as the shock it gives is but small. It is not surprising, therefore, that Capt. Bogardus, using his ponderous gun and 5drs. of powder, should, with No. 8 shot, lose more wounded birds than Mr. Aubrey Coventry, who used a gun only two-thirds the weight of the other, and with two-thirds the quantity of powder, but No. 6 shot. With nearly double the number of pellets, the chance of hitting was, of course, very much greater; but a stout blue-rock takes a pretty heavy blow to drop him with certainty.

The above tables, however, do not demonstrate the whole of the increase of power in the larger pellets, because each line of a table gives a uniform velocity for all the sizes, whereas the figures previously given showed that the light pellets lose speed more rapidly than the heavy. In short, greater weight in proportion to surface enables the shot to make greater progress alike through the atmosphere and through paper pads. The highest "final" velocities, on the average of the two powders used with Mr. Griffith's gun, were as follows:

| | No. 2. | No. 3. | No. 4. | No. 5. | No. 6. | No. 7. | No. 8. |
|---|---|---|---|---|---|---|---|
| | f.s. | f.s. | f.s. | f.s. | f.s. | f.s. | f.s. |
| Final Velocity... | 591 ... | 617 ... | 580 ... | 571 ... | 557 ... | 512 ... | 508 |

The energy of the respective pellets, as shown in these averages, will be represented by the following numbers, in foot-pounds:

| | No. 2. | No. 3. | No. 4. | No. 5. | No. 6. | No. 7. | No. 8. |
|---|---|---|---|---|---|---|---|
| Foot-pounds ... | 2·94 ... | 2·67 ... | 1·85 ... | 1·45 ... | 1·12 ... | 0·74 ... | 0·58 |

And the foot-pounds will give the following penetration—calculated, as before, on the diameter and specific gravity of the pellets, and the nearest number of sheets without fractions.

| | No. 2. | No. 3. | No. 4. | No. 5. | No. 6. | No. 7. | No. 8. |
|---|---|---|---|---|---|---|---|
| Sheets.............. | 34 ... | 35 ... | 28 ... | 26 ... | 23 ... | 18 ... | 16 |

Compare these lines with lines at equal velocity, and the difference will be obvious.

For the purpose of this estimation, I have supposed the paper pads to afford equality of penetration; but one of the disadvantages of paper pads is that they do not give this equality, as the nearer the pellets get to the back of the pad the easier the penetration

becomes. Consequently, paper pads favour the gun giving the highest penetration, and are especially favourable to one throwing a cluster of very fast pellets, which have a higher velocity than the main body of the charge. In this respect the paper pads have the very opposite effect to that of the force-gauge, which, as Mr. Griffith has demonstrated, penalises unequal velocities.

It is obvious enough that, if the force of the charge is estimated by the penetration of three pellets only, no advantage is scored in a trial by fifty pellets on a pad all piercing the same number of sheets; nor is there any loss if forty out of the fifty pellets do not penetrate half so far; whereas, with the force-gauge, the "force per pellet" of the same charge would be ruled by the majority of the pellets, although the chronograph may show that the first pellets striking the target had an exceedingly high velocity.

When, as in the trial of 1878, we see one barrel of a gun shooting the whole of its charges without a variation of more than two or three sheets from the average, while the other barrel, with exactly the same load, shows double the penetration in one round that it does in the next—jumping up a dozen sheets above the average now, and then falling considerably below—we naturally conclude that the one barrel gives better shooting than the other; yet we may find that the irregular barrel adds most to the average score. It is the tendency of the paper pads to enable it to do so; but this would have not been so evident had it not been for the *Field* trial of explosives in 1878.

After the main trial at forty yards, several of the guns were tried again at longer distances, and it was thought the penetration would be so much reduced that pads of twenty sheets would suffice, the average penetration of the whole of the choke-bores at forty yards having been only twenty-five sheets, while that of the cylinders was less. It was found, however, when the first gun was tried with No. 6 shot at fifty yards, that it penetrated every sheet in the pad time after time.* When five-and-twenty shots had been fired, and twenty-four pads penetrated throughout, the pads were increased by five sheets, the charge being exactly the same as before, except that the powder was by another maker. Now the penetration (with only five sheets more in the pad) never exceeded seventeen sheets, the average being but little over fourteen; and it could scarcely be said that the defect was in the powder, because

* See records on page 79, *et seq.*

this had shown higher penetration than the other in the main trial. Afterwards the same gun was tried with No. 5 shot at pads of the same thickness (twenty-five sheets). As every sheet was penetrated again and again, pads of forty sheets were substituted, whereupon the average penetration, with the same powder and shot as before, fell below twenty-two sheets.

The explanation of this seems to me to lie in the fact that between the sheets of paper there are layers of air that serve to make the sheets a succession of springs, the elasticity of which has to be overcome, in addition to the toughness of the paper. It is difficult to estimate the proportion which this spring-resistance bears to the natural resistance of the paper, and experience shows that it varies with the state of the atmosphere and the quantity of moisture which the paper accordingly absorbs; but, supposing it to be only 1 per cent. (and the above-mentioned results would seem to indicate its being sometimes more than double that), an idea of its effect may be formed by considering that the pellet, on piercing the first sheet in a pad of forty, has to overcome not only the resistance of the sheet of paper (which may be represented by the figure 1), but the elasticity of forty sheets (each, at 1 per cent., being represented by ·01). Together we thus get 1·40 as the amount of resistance overcome in penetrating the first sheet; with the second sheet there would be one fraction less of elasticity, and the resistance would be 1·39; with the next sheet 1·38, and so on down to the last, which would be 1·01. Consequently, supposing a gun to penetrate usually but little over twenty sheets, and once now and then to jump to forty, it would in the first twenty have encountered an average resistance of 1·30, but in the next twenty would have met an average resistance of only 1·10; and in all probability, although three pellets penetrated the forty sheets, there would be on the same pad a score or more that did not get half as far.

On the force-gauge we do not find such extreme aberrations, although there are differences in successive shots from the same gun with the same charge, and greater variation in some guns than in others. Occasionally (and especially at 60 yards) we find very low results with a very thin pattern, there being but half a dozen pellets on the 10in. plate (100 square inches); and, where these occur, they seem to be parallel shots to those which, with paper pads, scored 0, from the inability of three pellets to get through a single sheet; but with the paper pads the fall is from 30 or more down to 0 in these futile shots, whereas with the force-gauge the

greatest drop I can find is in the proportion of only 7 to 1. In the whole of the trials at 40 yards, in May, 1879, I see but two guns that ever dropped to anything like half their average pellet-force; and the worst of these offenders was a 20-bore, that on one occasion put but five pellets on the 10in. plate, and on another six. A large pattern, however, was not essential to a high score, for another gun by the same maker put only nine pellets on the gauge, yet the force per pellet of these nine was rather above the gun's general average; while other charges from the same gun, with five or six times as many pellets on the gauge, gave under the average pellet-force. Similar results occurred continually, both in the *Field* trial and in Mr. Griffith's experiments. On the other hand, the extremes alluded to as occurring with the paper pad may be frequently found in the report of the 1878 trials; and it would therefore seem that the paper-pad mode of scoring exaggerates the irregularity of penetration, and may put a gun with good and regular penetration behind one that has but a modicum of faster pellets. In the force-gauge these faster pellets are penalised by the action of the spring.

Regularity in shooting power is quite as essential in a gun as regularity of pattern or of recoil; and it has occurred to me as strange that, whereas irregularity in these two latter respects has been heavily penalised, there never has been a penalty on irregularity of penetration. The action in the spring of the force-gauge, by the curves described in Mr. Griffith's first experiments (p. 44), appears to unexpectedly provide such a penalty; and, although it may detract from the merits of the gauge as an accurate recorder of *inferior* results (especially with the very small pellets which have little individual momentum), yet it is probable that the majority of sportsmen may agree with Mr. Griffith's opinion that this penalising of wild shots "is an important point to be welcomed in the force-gauge."

# CHAPTER XII.

## WADDING.

### Objects of Wadding and the Various Kinds Required.

Until about the year 1855 shooters were content with a card wad over the powder and another over the shot, sometimes cut out of an old hat; but at that time, and with this kind of wadding, a muzzle-loader became so foul after twenty-five or thirty shots as to be unfit for any ordinary shoulder. The late Mr. W. Greener then introduced a thick felt wad (about ¾in. long) slightly greased, and at my first gun trial of 1858 offered me a bet that he would with its aid fire 100 rounds from a muzzle-loader without fouling any part but the breech chamber to any appreciable extent. I did not accept the offer, but I satisfied myself of the advantage of this wadding, and since that time I have been more and more convinced of the great improvement effected by it. But its utility is chiefly as a lubricator, except that in the breechloader it bridges over the space between the cartridge case and the bore of the barrel (called the cone), where its thickness serves to prevent the escape of gas. Otherwise it does not confine it so well as the "pink edge," composed of fine felt, also greased, but not so thick as the ordinary felt. This is too soft and elastic to keep the gas from passing by its side, as may be easily proved by examination of the wads used in a gun without any aid behind them, such as is afforded by what is called the "pink edge" wad. This also is made of felt, but

it is of a very hard and compact nature, and though it lubricates by virtue of the small quantity of pink coloured grease, which gives it its name, the amount is too small to act sufficiently as a lubricator. Hence it may be assumed that the ordinary felt wad is chiefly a lubricator.

For this purpose the wad is dipped in melted grease composed of lard, coloured pink; but as this grease quickly decomposes the powder in contact with it, in order to prevent its escape into the powder it is necessary to interpose another wad, grease proof, and this should always be done.

Soon after the gun trial of 1878, in which the Schultze powder had shown such irregularity of shooting as to lead to its being beaten by its black competitors in spite of its superior force, I carried out a long series of experiments in which I ascertained that the proper development of its strength does not depend on the degree of its compression as then supposed, but on the amount of resistance afforded to its initial explosion. I found by thousands of experiments with a powder gauge, which I constructed, that if the cartridge case is not turned over properly, or the wads in it are loose, the Schultze powder will explode very irregularly, sometimes going off like a squib, and at others exerting a dangerous degree of force. But by placing over the powder a firm wad, such as the "pink edge," half a size larger than the bore, and using no compression, a regular amount of energy is displayed, and a corresponding pattern is obtained with a good development of force. This result I at once (July 20th, 1878) announced to the readers of the *Field*, and soon afterwards extending my experiments to black powder, I found nearly, but not quite, as much advantage from the tight wad as with the wood powder. I then stated "This wad should on no account drop freely into the case, and should be large enough to require some little force to drive it into its place; over this a firm felt wad should be lightly placed." Herein is contained the whole of my discovery, for

such undoubtedly it was; and its general adoption by the public since that time shows their appreciation of it. Soon afterwards (May, 1879), both Mr. Greener and Mr. Bartram claimed a priority, each alleging that he had loaded in the same way some time before. To their statements I replied in the following note:

We have not contended that Mr. Greener's 1878 guns were not more regular in pattern than those of his then competitors; but what we have said is that their patterns would not, on the average, compare with those made since we published our experiments in the summer of 1878. The same gun which made the wonderful pattern recorded above with the C. and H. powder fell to 141 and 152 with Hall powder, and to 100, 136, 151, and 148, with Schultze. Now, we showed by experiment, subsequent to the above-mentioned trial, that the tight wad prevented such wild shots; and therefore it is fair to assume that the tight wad had not previously been used by Mr. Greener. At all events, if so used, its utility was confined to himself, and, so far as the public were concerned, it was undiscovered. Moreover, we saw Mr. Greener's assistant load all his cases, and unhesitatingly state that his card wads were not tight, though the felt were, the former dropping readily into the cases. If the wads had been tight, surely we laid ourselves open to the charge of wilfully producing as a novelty that which we must have known to be a plagiarism, yet such a charge was not made by Mr. Greener; and we leave it to our readers to come to the conclusion whether or no he is a person likely to let such an opportunity pass, especially when a claim to the prior discovery was made by another gunmaker. We called attention to the advantage of the tight wad several times about three months after the trial of 1878. In the *Field* of Aug. 17, 1878, we said: "As to the felt wad, there is no necessity for having it larger than the diameter of the case, the improvement in shooting being chiefly dependent on the initial pressure given by the card wad, which is not so easily compressed as the felt." And in the *Field* of Nov. 9, 1878, we gave a lengthy account of a trial we had carried out with a gun of Mr. Maleham's that had been shot in the competition of the previous May, and we reprinted for comparison "the highest score made in May by Mr. W. W. Greener's choke with black powder, which has always been considered to be a wonderful performance." Mr. Maleham's choke, with 42grs.

Schultze, had in the May trial given only an average pattern of 169, with many wild shots (69, 71, 72, 77, and 95); but the same gun, under the same conditions—except that the charge was 36grs. of the new Schultze powder (which was somewhat stronger than that used in the May trial) and that the card wad was tight instead of loose—gave not only much greater penetration, but an average pattern of 221, without a wild shot; for out of twenty-five shots the lowest pattern was 200. The result, as we remarked at the time, was "an extraordinary score, beating Mr. W. W. Greener at all points by a figure of merit of 147·36 against 88·36 calculated on the trial conditions.—Ed.

To this Mr. Greener rejoined the annexed letter, and I again appended a footnote:

Sir,—In answer to your footnote, our book, published in 1877, proves that we had used and advocated the use of two felt wads over the powder prior to that date. To the best of our knowledge, it was not until the 17th of April last that you claimed to be the first to have used that system of loading, and that you discovered its advantages at your private trials with a force-gauge in November, 1878. Thinking it best to undeceive you, we wrote the following week, and moreover stated that the wads we had made use of were tight. You then in a footnote shifted your ground, claiming priority for discovering the merits and demerits of tight wadding. We again wrote, giving the results of experiments in which equally regular results were obtained with ordinary loading, and giving, as we supposed, sufficient proof that the wads we used were tight. Last week you, although not contradicting our statement, introduced a rider saying that our "card wads were not tight, although the felt were." Now, Sir, we have never claimed the priority of using tight card wads, and, if that had been all you originally laid claim to, we would certainly not have commenced this uninteresting discussion.

We must take exception to the concluding sentence of your footnote; and, considering that at that private trial you introduced a new standard test for guns, and never tried our winning guns under the same conditions, it was erroneous on your part to draw conclusions between the performance of our guns under the ancient *régime* and that of another maker under the new. It being a matter of sheer impossibility for you to prove that our gun was beaten in penetration, your statement "beating Mr. W. W.

Greener at all points" is void, unless qualified by a lengthy context, although certainly liable to mislead any person not thoroughly acquainted with the details of the two 1878 trials.

W. W. Greener.

St. Mary's Works, Birmingham, May 12, 1879.

[Mr. Greener is altogether mistaken as to his dates. On the 20th July, 1878, we first propounded the theory that compression *per se* has no effect on the Schultze powder, and that the proper development of the gas when pressure is used is simply due to the increased *tightness* of the wad. Our words were: "This end" (rapid ignition) "can be far more easily and surely effected by using a full-sized thin wad over the powder, and merely seating it exactly as is required for black powder, so as to insure a sufficient initial resistance. . . . This wad should on no account drop freely into the case, and should be large enough to require some little force to drive it into its place. Over this a firm felt wad should be lightly placed." We returned to the subject on the 10th, 17th, 24th, and 31st of August, 1878, when Mr. Bartram urged a prior claim; and finally on Nov. 9 in the same year. In all these cases we claimed the use of the *tight* wad, and no other, as our improvement, and we cannot understand how Mr. Greener could possibly misunderstand us. As to the "private trial" of the new method of loading, we never assumed that the results showed any superiority in one *gun* over the other; and, indeed, we at once stopped the attempt to make our advertising columns the medium of such a claim. All that we stated was that the difference of wad made a difference in the shooting; and that the same gun which had in the previous public trial been disposed of by its wild shooting, had, by merely adding a tight wad over the powder, given a regular pattern, greater even than that of Mr. Greener's wonderful score in the previous public trial. We certainly could not *prove* that it beat the latter *in penetration*, but argumentatively we assumed it, and still have reason to believe that we were right. Our main position, however, was in reference to the pattern, Mr. Greener's claim having been made especially with regard to regularity of shooting; and in the case we quoted there could be no dispute on this point.—Ed.]

This ended the matter as far as I was concerned, but a warm correspondence ensued between Mr. Greener, Mr. Green of Cheltenham, and Mr. Leeson of Ashford, to which I need

not refer, except to remark that it supported my claim, which in fact is now undisputed. In his recent work on the Gun, however, Mr. Greener contends that the tight wad is of no use. At page 437 the following passage occurs: "Others contend that to get the best shooting the wads *must* be from one quarter to three-fourths of a size larger than the case, speaking learnedly of expansion, bridging over chasms, burning out the edge, &c.; forgetting that a thin loose felt wad expands as fully as a tight one, and that the elasticity of felt wads is such that one, three-fourths of a size larger than the bore of the cartridge case, may be easily compressed with the fingers until it is of the size of the case, the wad gaining in thickness what it loses in diameter. With loose wads the reverse takes place upon the explosion; the blow given the wad is more sudden than any that can be given by hand, and it is as it were 'jumped up,' the wad diminishing in thickness but expanding as much as the *barrel* will allow, and a tight wad can expand no more." Now here we have a series of fallacious theories opposed to my single demonstration of fact, namely, that a *tight* pink-edged wad, (not the felt wad alluded to above) greatly improves the shooting of a gun. As I stated in my first announcement, the felt wad should simply be firm and *lightly placed*, which it cannot be if "three-fourths of a size larger than the case." Mr. Greener forgets that gas presses in all directions – on the sides if it can get there, as well as on the base of the wad; and that it does get there is proved by the carbon deposited on a loose felt wad unprovided with a protector between it and the powder. Whatever advice Mr. Greener may give to his readers, he took good care to use a tight wad in his 1879 trial, nor did he then dispute its efficacy. What is most remarkable is, that if he thought my plan of loading useless, he should have claimed it as his own, and that when his claim was shown to be unfounded he should declare that he only used tight *felt* wads and not tight *pink edged*. Finally, he argues in the above quotation that a loose

wad is better than a tight one, and there I leave him. At all events a tight pink-edged wad, which he repudiates, has been since 1878 in general use; it should be about half a size larger than the bore of the gun; and no compression is now considered necessary for the Schultze powder. A speciality, called "the *Field* wad," was devised in 1879 at my request, and is now in very general use. This is composed of hard and very fine felt, about ⅛in. thick, rendered grease proof by a black composition on the side next the powder, and lubricated to show a pink edge on the other side.

I prefer the thick felt wad to be loose, first, because if so the grease contained in it is more readily squeezed out by the pressure of the powder gas; and, secondly, because it is more readily put flatly into the case on the top of the pink edge, which it then compels also to assume a level position on the powder. But from the quantity of grease contained in it the pellets of shot lying next to it are very apt to adhere, and cause the pattern to be patchy. The extent of this defect varies greatly in different guns, and is often independent of the above cause. In any case those shooters who are particular in getting the best possible results prefer to have a very thin card wad between it and the shot; but the improvement effected by it is so slight as to be scarcely worth doing for sport, though in a trial of guns it should be attended to.

Lastly, a thin card wad, of the exact bore of the gun, should be placed over the shot. Many gunmakers have been of opinion that a thicker wad is better, and on my publication of what I considered the best kind of wadding, in 1879, a long correspondence in the *Field* ensued on the subject, which was finally disposed of by the following experiment, since the publication of which the thin card wad over the shot has been almost universally adopted:

SIR,—In compliance with the request of "Lecale" in your issue of the 10th ult., I have tried a few shots at the *Field* force gauge

with a 12-gauge choke-bored gun, ordinary length chambers for Eley's and other stock cartridges, distance 40yds., target 30in. circle, with force gauge fixed in the centre. The cartridges were loaded as follows: 3drs. C. & H. No. 6 powder and 1⅛oz. No. 6 chilled Newcastle size shot (about 270 pellets per 1oz.); wadding as per *Field* directions for loading 12-gauge cartridges. I used the 11½-gauge black and pink, and 11¼-gauge ⅜in. felt wads for over powder.

**No. 1. Wadding as above described.**

| On gauge. | Per pellet. | 10in. | Total pattern. | |
|---|---|---|---|---|
| 95 | 1·90 | 50 | 206 | |
| 104 | 2·26 | 46 | 210 | Average force... 2·02 |
| 115 | 2·05 | 56 | 230 | Ditto pattern 213·4 |
| 97 | 2·07 | 47 | 217 | |
| 71 | 1·82 | 39 | 206 | |

**No. 2. Same loading as above, with ⅛in cloth wad over shot in place of thin cardboard.**

| On gauge. | Per pellet. | 10in. | Total pattern. | |
|---|---|---|---|---|
| 75 | 1·79 | 42 | 176 | |
| 87 | 2·17 | 40 | 194 | Average force... 1·93 |
| 52 | 2·08 | 25 | 177 | Ditto pattern 165 |
| 27 | 1·80 | 15 | 153 | |
| 31 | 1·82 | 17 | 125 | |

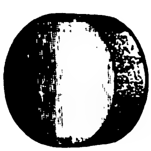
**No. 3. Same loading as No. 1, with 1¼oz. No. 6 Shot.**

| On gauge. | Per pellet. | 10in. | Total pattern. | |
|---|---|---|---|---|
| 90 | 1·84 | 49 | 207 | |
| 105 | 1·64 | 64 | 237 | Average force... 1·76 |
| 76 | 2·00 | 38 | 213 | Ditto pattern 219·3 |
| 92 | 1·77 | 52 | 222 | |

I consider the latter charge a disproportionate one, and I should recommend "Lecale" and others who wish to use heavy charges to have their barrels (if sufficiently strong at the breech ends) chambered to take an extra long cartridge case. W. P. Jones.

75, Bath-street, Birmingham.

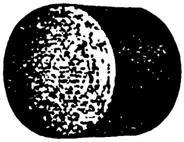
We may, therefore, come to the conclusion that three principal kinds of wadding are required for shot guns, leaving the further consideration of the method of loading with them to the next chapter. These three kinds are:—



Field Wad (grease proof).

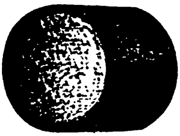
1. A grease-proof pink-edged fine felt hard wad, known as the "*Field* wad."

2. A felt wad containing the lubrication necessary to keep the barrels clean, and varying in texture and thickness as follows:



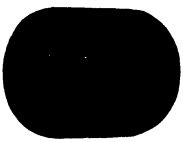
a

(*a.*) Extraordinary size ($\frac{5}{8}$ inch) used for small charges to fill up case.



b

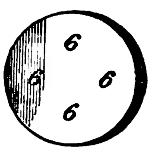
(*b.*) The ordinary size ($\frac{3}{8}$ inch) especially when used with *Field* pink edge.



c

(*c.*) A brown felt wad of hair and wool mixed, used by Mr. Baker and others, who consider that it gives better results than felt made of wool only.

FELT WADS.




SHOT WAD.

3. The card wad over the shot which, to avoid mistakes, should have the size of the shot printed on each, thus: 4, 5, 6 or 7.

In addition to these three, plain black very thin grease proof wads are made, to be used when there is not room in the case for the *Field* wad, or when the shooter has no faith in that kind; and also white and brown cloth wads for insertion among the shot, in order to cause it to spread, or to be substituted for the card wad over the shot by those who approve of exploded practices proved to be erroneous. Lastly, the thin brown wad to prevent adhesion of the shot to the felt wad noticed at page 371.

# CHAPTER XIII.

## LOADING CARTRIDGE CASES.

### SECTION I.

#### General Remarks.

From a considerable experience at the different gun trials under my management, and also in the field, I am satisfied that a moderate gun well loaded is better than a super-excellent one mismanaged in this respect. Over and over again I have said to those who have submitted to me a gun to be tried by themselves in my presence, "If you will let me load your case I will beat your performance by 10, 15 or 20 per cent.;" and the result has invariably been as I predicted. There is no doubt, moreover, that a variation in the proportions of powder and shot and in the wads used over them, as well as in the turning over of the cases, has the effect of scattering the charge or the reverse, as I shall presently show. Wads are usually ·010 inch larger than the size by which they are described.

### SECTION II.

#### Loading Paper Cases.

The first point to be considered in loading cartridges is the number required. If the shooter only wants forty or fifty, nothing more is necessary than a wooden plunger of the suitable gauge and a turn-over machine. Provided with these and two measures, one for powder and another for shot, he pours

his powder into one basin and his shot into another. Then standing his cases upright he fills the whole, one after another with the powder. The next operation is, put in the powder

THE REVIÈRE AND BAKER CARTRIDGE CLOSER.

wads which must be done with some care, especially the "pink edge," as this is always required to be tight. It may, however, be safely placed in edgeways, for the felt wad over it puts it right, and the two may be pushed down on

the powder together, taking care just to seat them firmly, but no more. Next fill in the shot and then carefully put over each its proper card wads,—but here some little dexterity is needed or the wad will not lie level for the turn over. Lastly, turn over each case separately, for which purpose I know no machine so good as that patented by Mr. F. Baker, in conjunction with Mr. Revière, who is a practised shot.

At first sight, the machine seems to resemble the ordinary one, but on examination it is seen that the frame is double—the internal one, to which the lever is fixed, moving in a cam cut out of the external frame. In this way increased power is given to the pressure of the left hand, and, as it can readily be graduated, the result is that the case is turned over expeditiously and smoothly. It is used in the same manner as the ordinary closer, but the lever being worked as before mentioned prevents any irregularity or creasing in the cartridge.

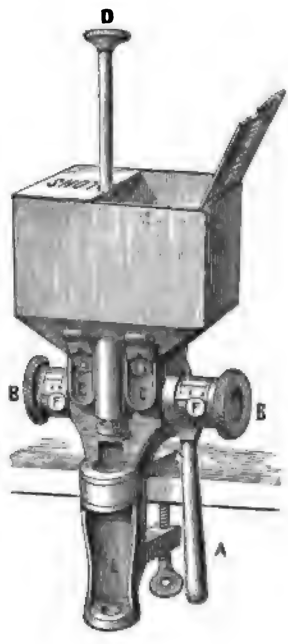
### Dixon's Shooting Box Companion.

Where there is a gun room, powder and shot chargers containing a pound of each assist in this operation materially. A simple apparatus under the above name is commonly sold, with turn-over complete, at prices varying from 2*l.* 10*s.*, alone, or with turnover and extra board, 5*l.* 5*s.* With this apparatus complete 200 cases may be loaded in the hour by a practised hand, while with the unassisted plunger, and the turnover it requires some dexterity to load fifty. If there is not space for this companion one or other of the following machines will be found to answer.

### North's Patent XL. Cartridge Loader.

Brought out by Messrs. North and Co., of 11, John-street, Handsworth, near Birmingham. Its chief features are its simplicity, portability, and cheapness, as compared with the loader by the same inventor on which it is founded. First,

in simplicity, the turn-over complication is dispensed with, it being found that a turn-over machine, such as Baker and Revière's, does the work far better and quicker than that part of the combined one. Secondly, the improved machine is only 9in. by 4in. by 3in. in dimensions, and will go into an ordinary gun case. Thirdly, the price is




North and Co.'s XL. Machine.

only 25*s*., making the cost, with the turn-over machine, about 2*l*. 2*s*. The engraving represents the machine with the powder chamber opened for filling. The powder and shot being both inserted, the method of proceeding is as follows, as directed by the inventor: "A cartridge is placed mouth first in the recess E; the charges having been adjusted by loosening the thumb-screws FF, and then moving the slides BB, till the black line seen through the upper slot

corresponds to the charge desired, which is marked on a scale as shown in figures. Now turn the lever A upwards as far as it will go, this cuts off the exact charge of powder and passes it into the cartridge case; place a felt wad on the guide leading to the open mouth of the cartridge case, ram down the rammer D, then lower the lever A to its original position, by which the charge of shot is cut off and passed into the cartridge. Place another wad as before, and ram it down, and the cartridge is loaded. Now take it out brass end first." It should be mentioned that the charges can be increased, but not reduced, after the powder and shot are introduced. I can strongly recommend this machine to the sportsman as better suited to his purpose than the Erskine; for, although it will not load quite so fast when large numbers are required, yet for all ordinary purposes it is sufficiently rapid, while the wads are inserted in a more level condition, and are pushed home with more certainty.

Next to this, in my opinion, comes the Lancaster machine, which certainly does its work remarkably well, and will load 100 cases in three-quarters of an hour.

This machine has been specially invented to prevent the bulging of cartridge cases when large wads or heavy charges are to be loaded, when they are otherwise often too tight to enter the chamber of the gun. The following directions will show the way in which the machine is to be worked.

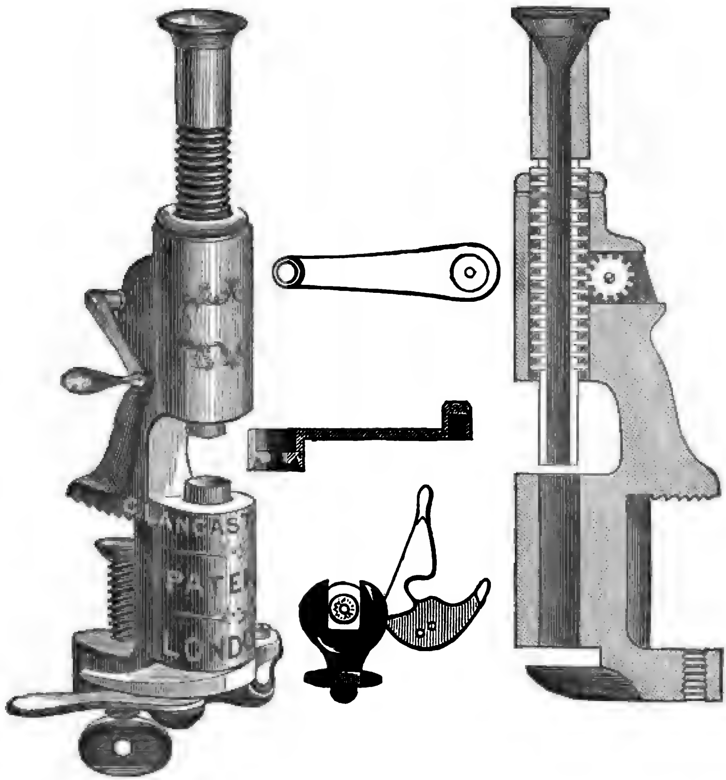
First. Screw the machine by means of the thumbscrew firmly on the corner of a table or bench.

Then arrange two bowls to hand, one for powder and the other for shot, also the requisite wadding, and the empty cases.

Second. Draw aside the hinged iron or brass bottom plate, introduce the cartridge case into the chamber (which is to the correct size of Eley's universal cases of whatever bore), and close the hinged *brass* plate only, under the base of the

cartridge, which is thus supported in proper position for loading.

Before putting in the powder, press the plunger into the mouth of the case in order to widen it, so that the wads will pass in freely. The charges of powder and shot should be




C. Lancaster's Patent Cartridge Loading Machine.

put in the plunger at the top, which acts as a funnel, and allows the whole charge to be placed in the case without fear of spilling.

After the charges of powder, shot, and the wadding have been loaded into the cartridge case, push the case up from the base so that the iron plate can pass under it also; this raises

the mouth of the case above the chamber, and so allows the grooved or hollow tool for rounding over to be applied to the case.

When applied, press the plunger firmly upon it with the left hand, and at the same time turn the tool round with the right hand backward and forward about a quarter of a turn each way; this turns down or rounds over the edge of the paper neatly all round, and finishes the loading of the cartridge. Then open the hinged plates and push out the loaded cartridge.

Price for 28, 24, 20, 16, 14, and 12-bore, 2*l.* nett. 10, 8, and 4-bores according to length of cases. This is about the same as Mr. North's. This machine does its work very satisfactorily, and is the only one used in filling the large supply of loaded cartridges sent out from Mr. C. Lancaster's establishment.

### The Erskine Loading Machine.

The Erskine machine is wholly unsuited for the private gun room, and only serves the purpose of those who load for sale. I shall therefore omit any description of it.

### Swedging Cartridges,

Unless the chambers are very large, paper cartridges, when loaded, should always be passed through a gun-metal swedge ·003 inches less than the bore of the chamber, so as to ensure their entering freely.

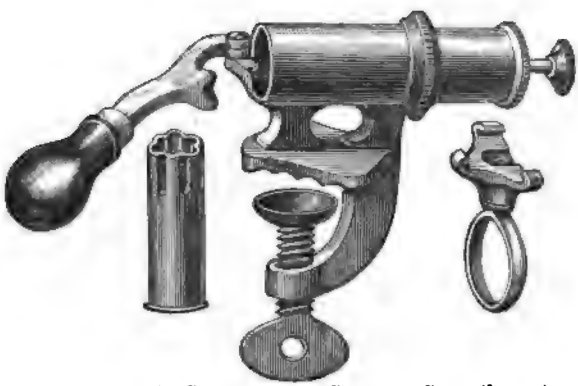
## SECTION III.

### Loading Brass Cases.

These cases are loaded in the same way as the paper, but do not require quite such tight pink-edged wads; or rather the tight pink-edged wad is comparatively useless, because the brass will not expand to receive it. The initial pressure required therefore for Schultze powder must be chiefly

given by the means which are adopted to keep in the wad, to which I shall presently advert. For this reason, with very sensitive powder, such as the E. C. No. 16, as good shooting is not obtainable with the brass as with the paper case, but with Schultze powder, or E. C. No. 12, the crimping of the mouth of the case and a wad ·010 inch larger than its bore will suffice to give good shooting.

There are various modes of seating the wads; but the only really effective ones, as far as my observations go, are Mr. Greener's Crimper and the Creaser of the National Arms Company, to be presently described. The former externally resembles a common turn-over machine, but internally has several projecting cones near the bottom. Against these the loaded case is driven by the pressure of the plunger, the result being that the case is crimped down to the level of the shot wad, as shown in the annexed engraving. Messrs. Kynoch



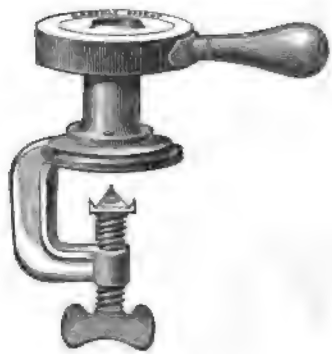
MR. GREENER'S CRIMPER AND CRIMPED CASE (½ SIZE).

advocate the use of a swedge, also applied on the plan of the same machine, the case coming out in the annexed form, with the mouth contracted or swedged in as there shown. The amount of force required is too great for an amateur to use himself, and in Messrs. Kynoch's factory the swedging is done by a heavy lever about 2ft. in length. I object, however, to the

principle of this swedging, as there is a space left between the swedged part and the chamber where the fouling collects,

"PERFECT" CASE LOADED AND SWEDGED.

leading to bad shooting. A third plan is that of the National Arms Company, in which three long indentations are made in the brass by a little machine of the annexed form, in which a



CREASER OF THE NATIONAL ARMS COMPANY (two-thirds size).

turn of the handle drives three teeth inwards against the case, leaving the indentation as shown below. It is called a


CASE OF THE NATIONAL ARMS COMPANY LOADED AND CREASED.

"creaser," and answers well enough for one or two loads; but

after this the indentations, being all at the same part, have a tendency to cut the end off.

A fourth plan has been suggested in the columns of the *Field*, namely, the use of the ordinary turn-over on the brass case, turning its edge down slightly; and this has also been applied to the Lancaster machine, described at page 379. If used, the case should be filled up to within $\frac{1}{8}$in. of the mouth by inserting, before putting in the powder, thick card wads (ungreased) with large holes cut in them. It is easy to ascertain the number required by trying one or two before loading the bulk, and as the powder lies in the middle, the cap flame reaches it as quickly as usual.

## SECTION IV.

### Concentrators.

Mr. C. Lancaster invented a plan about fifteen years ago by which a cylinder gun could be made to shoot as closely as a modern choke, or very nearly so. I agreed to test his "concentrator" with a gun made for me by Mr. Westley Richards, which I knew to be a good one, and which is alluded to at page 149 as the best cylinder gun I have ever known. In a trial, which came off in the spring of 1869, the following was the result, and I have since found the same per-centage of improvement generally take place with every gun I have tried. I provided the cartridge cases, powder, shot (No. 6), wads, &c., necessary for loading. In my presence fifty cases were loaded in the ordinary way, and the same number with the concentrators, which are merely cylinders of very hard paper, half an inch long, and fitting inside the cases. After putting in the shot, one of these cylinders is dropped upon it, the ordinary wad is then pushed in, driving down the cylinder around the shot, and the case is turned over in the ordinary

way. After firing about a dozen shots of each kind at the target, and satisfying myself that there was no tendency to ball, I proceeded to try six consecutive shots of each kind for pattern, with the following results, the plate being of 30in. diameter, and the range 40 yards :—

| | Plain. | | With Concentrators. | |
|---|---|---|---|---|
| No. 1 ... | 154 | pellets | 172 | pellets. |
| No. 2 ... | 170 | „ | 219 | „ |
| No. 3 ... | 139 | „ | 203 | „ |
| No. 4 ... | 158 | „ | 112 | „ |
| No. 5 ... | 196 | „ | 224 | „ |
| No. 6 ... | 90 | „ | 192 | „ |
| | 907, average 151. | | 1122, average 187, | |

or about 24 per cent. increase.

I then tried six shots of each for penetration, firing both barrels at the ordinary gunmaker's paper, which is much thinner than that used in the *Field* trials, viz. :—

| | Plain. | With Concentrators. |
|---|---|---|
| No. 1, No. 2 | Through 38 | Through 45 |
| No. 3, No. 4 | „ 32 | „ 48 |
| No. 5, No. 6 | „ 53 | „ 64 |
| | Total 123 | 157, or |

an increase of 28 per cent.

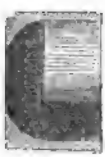
There was not a single failure or approach to balling in any of the fifty shots fired.

In 1876 a match was arranged to take place at the Gun Club, at pigeons, to test the relative merits of choke-bore guns against cylinders.

Many of the competitors on the "cylinder" side used concentrators, and they won the match by scoring 59 at 27 yards, and 47 at 33 yards, against 57 at 27 yards, and 40 at 33 yards on the part of the "choke" side.

In 1877 a return match was shot, and concentrators were excluded, when the "choke" side beat those shooting with "cylinders;" plainly showing that the concentrators had proved of great service in the first match.

Since that time I have more than once tried the concentrator as now improved with a dome on the top instead of a plain cylinder, and find its effect very great in increasing the numbers of the pattern, but the regularity is not equal to that of a good choke, and moreover, it is apt to produce dangerous balling. It is almost needless to remark that it should not be used in the chokebore.



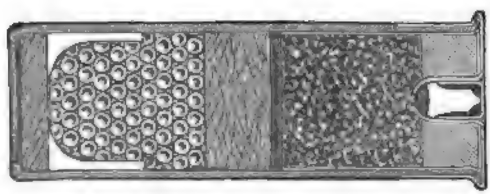


FIG. 1. FIG. 2.

C. LANCASTER'S IMPROVED CONCENTRATOR.

Figure 1 shows a section of the concentrator before loading, and Fig. 2 a cartridge loaded with it, the concentrator being pressed down after the shot has been poured into the case.

## SECTION V.

### LOADS FOR VARIOUS PURPOSES.

There are various proportions of powder and shot, and distributions of wads, which are suited to the different requirements of the sportsman. These I shall take seriatim.

## TABLE OF LOADS.

| | For Chokes and Cylinders. | | | | |
|---|---|---|---|---|---|
| | **Bore.** | **10** | **12** | **16** | **20** |
| For Ordinary Shooting. | Black powder ... ...<br>Schultze powder ...<br>E. C. No. 12 powder... | 4¼drs.<br>60grs.<br>65grs. | 3drs.<br>42grs.<br>48grs. | 2¾drs.<br>38grs.<br>43grs. | 2½drs.<br>35grs.<br>39grs. |
| | Pink edge wad ... ...<br>⅞ Felt wad... ... ... | 9½-gauge.<br>10-gauge. | 11½-gauge.<br>12-gauge. | 15½-gauge.<br>16-gauge. | 19½-gauge.<br>20-gauge, |
| | Shot No. 5 or 6... ... | 1⅜oz. | 1⅛oz. | 1oz. | ⅞oz. |
| | Shot wad ... ... ... | Thin card, rather loose. | | | |
| | Turn-over ... ... ... | The cases should be well turned down, especially for Schultze. | | | |
| For Hard Shooting. | Black powder ... ...<br>Schultze powder ...<br>E. C. No. 12 powder... | 4½drs.<br>63grs.<br>68grs. | 3¼drs.<br>46grs.<br>52grs. | 3drs.<br>42grs.<br>48grs. | 2¾drs.<br>38grs.<br>43grs. |
| | Pink edged wad... ...<br>⅞ Felt wad... ... ... | 9½-gauge.<br>10-gauge. | 11½-gauge.<br>12-gauge. | 15½-gauge.<br>16-gauge. | 19½-gauge.<br>20-gauge. |
| | Shot No. 5 or 6 ... | 1⅜oz. | 1⅛oz. | 1oz. | ⅞oz. |
| | Shot wad ... ... ... | Thin card, rather loose. | | | |
| | Turn-over ... ... ... | Cases should be well turned down, especially for Schultze. | | | |
| | For Choked Guns only. | | | | |
| For Rabbit Shooting or to Scatter for Tyros. | Black powder ... ...<br>Schultze powder ...<br>E. C. No. 12 powder... | 4drs.<br>56grs.<br>62grs. | 2¾drs.<br>38grs.<br>43grs. | 2½drs.<br>35grs.<br>39grs. | 2¼drs.<br>32grs.<br>35grs. |
| | Grease proof thin card wad ...<br>⅞ Felt wad... ... ... | 10-gauge.<br>10-gauge. | 12-gauge.<br>12-gauge. | 16-gauge.<br>16-gauge. | 20-gauge.<br>20-gauge. |
| | Shot 5 or 6 ... ... | 1⅜oz. | 1⅛oz. | 1oz. | ⅞oz. |
| | Shot wads ... ... ... | Two ⅛in. thick card wads, one over and the other in middle of shot. | | | |
| | Turn-over ... ... ... | If black powder, only turned down enough for safety; if Schultze, a little more. | | | |

The above loads are intended for guns of the average weight of their respective bores; but if above or below that average, the charges should be slightly increased or diminished, as the case may be. Invariably, however, the purchaser of a gun should consult its maker, as the charge used in regulating it is generally the best suited to it.

The larger the size of shot the less powder it will require in proportion to develop its best powers. This results from the diminution of friction which, for example, is, with equal weights, much greater in dust shot than in BB, and proportionally in the intervening numbers.

Where a gun shoots too close for the powers of its owner, it is better to increase the size of the shot when resorting to "scatter loading." No. 5 is not too large for a rabbit.

The following letter on "Loading" was written by a well-known correspondent of the *Field*, and though I do not in all points agree with the advice given, I append it as of great general interest:

The eventful "twelfth" is now rapidly approaching, and the festival of St. Partridge is not very remote, and men too are beginning to sound notes of preparation, and to be looking after their "irons;" hence a few remarks on this all-important subject may not be unacceptable to some of your readers.

I fear my experiences in this matter have led me into opinions that will at first appear to be dreadfully heterodox to many; and to such I will only urge that they read my views patiently to the end, and then institute a few careful experiments on the lines I propose to lay down, and see if I am not borne out by the results.

I must premise that these observations are intended to apply to guns of 12, 16, and 20-bores; of 10-bores I have no great experience, of 8-bores still less, and a 6 or 4-bore I have never yet fired, nor do I feel the slightest desire to do so.

In the first place, we will start with the broad proposition that in my opinion there has, during the last few years, been a growing tendency to overdo guns with powder; and this, in its turn, has induced heavier guns (thicker barrels) to absorb the heavy recoil.

Both, I venture to think, are steps in the wrong direction, especially the latter, as, throughout my pretty long experience, almost every gun showing exceptional powers in its shooting has been light and thin in the barrels, and by no means always involving the best qualities of metal—though, of course, the better the iron the safer one feels with a very light gun.

Mr. Greener, I know, at one of the *Field* gun trials, shot one of his guns, a 12-bore, with as much as $3\frac{1}{2}$drs.; but there was, I well remember, a difficulty in getting the load into the cases, involving thereby a compression of the powder by no means desirable; and, though the gun came out well, the impression on my mind at the time was, from the way the gun shot, and the appearance of the papers (every one of which passed through my hands), that the gun would have done better with $3\frac{1}{4}$drs.

Not very long ago I met with a man who told me his load was 4drs., and $\frac{3}{4}$oz. of No. 7, and that he did better with this load than any other. As I was told he was a very indifferent shot, I can well understand the result being as he stated at *short* distances; for the gun made a really very pretty pattern at thirty yards, well covering a disc of 38in. or 40in.; but at forty yards it would be a fluke to get a bird above once in a dozen shots, and at fifty it would have been little use to shoot at anything much less than a hooper! A very few shots at the plate satisfied him that he could get much better and harder shooting with 3drs. and $1\frac{1}{8}$oz. of No. 6.

However, this matter of loading is one of such vital importance that every shooter should render himself a thorough master of the subject, theoretically and practically, as on it will largely depend the amount of sport he enjoys. Many a man buys a 12-bore gun, asks the maker the load, and is told $3\frac{1}{4}$drs. and $1\frac{1}{8}$oz. No. 6, or thereabouts, and goes away satisfied. This is what the gun has probably been regulated for at forty yards, and may or may not be the *best* for the distance; and many men never think it necessary to try this at a mark. But what about any other distance under or over that; or for a different kind of game, requiring a larger or smaller-sized shot—either of which, if you want to get the best you can out of a gun, must be used in different proportions? This is all very well, and may satisfy a good many; but a scientific sportsman will never rest and be thankful on such very slender grounds as these.

There is no doubt that full justice is not done to a 12-bore when only No. 6 is used; and for general game shooting, No. 5 for a

12-bore, No. 6 for a 16, and No. 7 for a 20, will be generally found to be the best sizes and most suitable to the bores, and taken all round, produce the most killing patterns at all fair and ordinary ranges. If a gun of any bore is to be put to any special exceptional work, special and exceptional cartridges should be loaded for such occasions.

The table of loads published by "Wildfowler" in the *Field* are excellent in their way, so far as they go, as landmarks, but only so, as what is "sauce for the goose" is by no means "sauce for the gander" where guns are concerned, for a variation in a load which answers admirably in one gun may not, and often does not, in another of the same gauge. And consequently it becomes necessary to actually try at the target *every* load you intend to use in *every* gun, as there can never be any feeling of certainty without; and thus knowing to a nicety what a gun will, and what it will not do, under given conditions, gives a man an amount of confidence in his shooting which is sure to tell.

The first thing to be found out with a gun on trial is to ascertain the largest amount of powder to a grain that it will burn with a given weight of shot. This weight or normal load of No. 6 is now almost universally admitted to be $1\frac{1}{8}$oz. for a 12-bore, 1oz. for 16-bore, and $\frac{7}{8}$oz. for a 20-bore. This can be pretty readily ascertained in a few shots, increasing the powder from time to time. If at a plate, an educated eye readily detects the difference of force; if at pads, it is merely a question of counting the sheets perforated. Possibly half a drachm or so of powder may be added without producing additional force; and after this the force will actually diminish, though more powder is used, unless a heavier load of shot is put over it—which, however, is not often desirable, unless the size is increased. Owing to the increased resistance produced by the greater weight of shot, a larger quantity of powder is burnt, and consequently more force is obtained; but it is usually at the expense of all evenness in the pattern and regularity in the shooting. Go back therefore to the load which gave the greatest force with the *least* powder, and stick to that, except in the case of using a larger or smaller sized shot, as will be referred to farther on.

Now try how a little more or less shot will affect both the force and pattern. In a full choke it will not unfrequently be found that the increase of one-sixteenth of an ounce of No. 6 (about seventeen or eighteen pellets) will cause even a much greater number of

pellets to be put on the circle, and this without interfering with the strength. Here is, of course, a clear gain. And, again, if the pattern is uneven and patchy, a similar reduction in the load will often set all this right, and still leave the pattern full enough to be thoroughly effective; and it must never be forgotten that a gun that will put on an even regular average pattern, without open spaces, of, say, about 190 (or less even), and will go on at this shot after shot, is a much better gun and more reliable than one with an average of perhaps 220, with a patchy pattern and every now and then a wild shot.

In all these experiments wadding is an item of much more consequence than many imagine; and for obtaining the highest results probably the best plan, when there is room for it, is to put on the powder, first, a *very* tight-fitting card wad; on that an equally tight $\frac{1}{8}$in. pink-edge wad; then the thick $\frac{3}{8}$in. felt; and on that a slack-fitting thin card. The last prevents the shot clinging in the soft felt wad, as they will almost always otherwise do; and more than this, it is a *hard flat* surface, and, it is considered, delivers the shot with greater force and regularity—something like the difference which would be felt in receiving the same blow from a boxing glove and the hard naked knuckles. The less that is put on the shot the better; therefore, a slack-fitting thin card is all that is required. There is no question about it, that the mass of wadding over the powder recommended above will generally shoot harder and more evenly than if more powder and less wadding is used; and it cannot be too strongly impressed on everyone that all this must be found out for *each individual* gun.

For all general shooting it is much better to keep a gun to the sized shot for which it has been regulated; consequently, if a gun is required for exceptional purposes, it should be bored and regulated for the sized shot required, and kept to it; and there is little doubt a gun will accommodate itself more readily to a reduced load of shot of a smaller size than it was regulated for than it will to increased loads of the sizes larger. And now let us consider the loading of cartridges for special purposes.

It is not difficult to spoil the shooting of any gun—that is, to increase the spread and make it effective at short distances; but it is often very convenient to be able to do so, as for snipe, quail, and so on. And here I cannot agree with those who have recommended a reduction in the powder. This I consider a mistake, as it means a reduction in power, which never in any case can be desirable. Use

the same load of powder, and put on it a slack card and a pink-edge or only a pink-edge grease-proof wadding, and reduce the load of shot until you get the pattern required. On the shot put a tight card wadding, and fill up the case nearly to the top with common sawdust (well dried); on this put a pink-edge wad, and well turn over, and the thing is done.

Increasing the range and power of a gun is, however, quite another matter; but still in most cases this can be done by varying the proportions, and using larger shot. The larger the shot employed the less is the friction in the barrel; in consequence of this the load of shot may be increased without throwing any additional labour on the gun, or appreciably increasing the recoil. For a 12-bore the increase may be taken at about $\frac{1}{8}$oz. of shot for every change of number; thus, if the load with No. 6 is $1\frac{1}{8}$oz., for No. 5 it may be $1\frac{1}{4}$oz., No. 4 $1\frac{3}{8}$oz., and so on, to any extent that can be got into the shells. But for No. 4, or larger sizes, a reduction of about $\frac{1}{4}$dr. of powder is desirable, as the greater momentum of the heavier shot gives sufficient killing power at 60 yards or over, and the smaller charge of powder materially tends to keep the shot together and improves the pattern. With very large-sized shot the shooting is decidedly improved by filling up the interstices between the shot with bone-dust or hard wood sawdust—one is as good as the other. The rule holds equally good *e converso*, and for the smaller sizes of shot a similar reduction of $\frac{1}{8}$oz. per size should be made.

For the smaller bores the increase or reduction is about in the same ratio, subject to occasional variations. For a 20-bore it may be a sixteenth, and a 16-bore half-way between. The actual power or force will be found to be but very little affected or interfered with by these various loads, but of course more or less in different guns; and, if found material, must be provided for by some further adjustment of the proportions—not usually a difficult matter.

Some tables of loads are appended, but only as general guides or points of departure for experiment, and as such may be useful; but they are not intended for blind use out of any gun of the same gauge that may happen to turn up, as the results cannot be guaranteed. And it is utterly impossible, however extensive may have been the trials, to lay down anything approaching hard and fast rules. In point of fact, the very large amount of experiments carried out by the writer have only tended to show more fully the complete futility of anything of the kind.

TABLE OF GUIDE LOADS.

| Powder. Black or equal measure of wood. | Shot. | No. of pellets in load. Newcastle chilled. | Lane and Nesham's hard shot. |
|---|---|---|---|
| | FOR A 12-BORE. | About: | |
| $2\frac{5}{8}$ drs. | No. 3 ...... $1\frac{3}{8}$ oz. | 181 ...... | 187 |
| $2\frac{5}{8}$ drs. | No. 4 ...... $1\frac{3}{8}$ oz. | 220 ...... | 237 |
| 3 drs. | No. 5 ...... $1\frac{1}{4}$ oz. | 250 ...... | 270 |
| $3\frac{1}{4}$ drs. | No. 6 ...... $1\frac{1}{8}$ oz. | 303 ...... | 303 |
| $3\frac{1}{4}$ drs. | No. 7 ...... 1 oz. | 370 ...... | 333 |
| $3\frac{1}{4}$ drs. | No. 8 ...... $\frac{7}{8}$ oz. | 417 ...... | 399 |
| | FOR A 16-BORE. | | |
| $2\frac{1}{4}$ drs. | No. 3 ...... $1\frac{3}{16}$ oz. | 156 ...... | 163 |
| $2\frac{1}{2}$ drs. | No. 4 ...... $1\frac{1}{8}$ oz. | 180 ...... | 195 |
| $2\frac{3}{4}$ drs. | No. 5 ...... $1\frac{1}{16}$ oz. | 212 ...... | 229 |
| $2\frac{3}{4}$ drs. | No. 6 ...... 1 oz. | 270 ...... | 270 |
| $2\frac{3}{4}$ drs. | No. 7 ...... $\frac{15}{16}$ oz. | 347 ...... | 312 |
| 3 drs. | No. 8 ...... $\frac{3}{4}$ oz. | 417 ...... | 342 |
| | FOR A 20-BORE. | | |
| 2 drs. | No. 3 ...... $1\frac{1}{8}$ oz. | 133 ...... | 153 |
| $2\frac{1}{4}$ drs. | No. 4 ...... $1\frac{1}{16}$ oz. | 170 ...... | 184 |
| $2\frac{1}{2}$ drs. | No. 5 ...... 1 oz. | 200 ...... | 216 |
| $2\frac{1}{2}$ drs. | No. 6 ...... $\frac{7}{8}$ oz. | 237 ...... | 237 |
| $2\frac{1}{2}$ drs. | No. 7 ...... $\frac{3}{4}$ oz. | 278 ...... | 257 |
| $2\frac{3}{4}$ drs. | No. 8 ...... $\frac{5}{8}$ oz. | 300 ...... | 285 |

N.B. Less wadding is required between the powder and shot in the smaller bores than in the 12's, the cone in front of the chamber being shorter; and in the 20's a thick felt and thin wad is sufficient—otherwise some of the above loads would hardly be got into the ordinary cases.

There is no doubt that by the employment of modifications of these loads and the waddings as suggested, a full or extreme choke, when really good, can be loaded to shoot effectively, as regards both force and pattern, at any distance from twenty up to sixty yards, or perhaps a little over. At least, such has been the experience of the writer, due allowance being made for the difference in the shooting of guns, as it is not every choke that will do its work properly at even fifty yards, load as you will. But it must be again impressed on every shooter that nothing must ever be taken for granted in guns; neither these nor any other loads can be relied upon to produce the intended effects, but must be tried and patiently worked out in *each individual gun* until the proportions are found which suit its peculiar idiosyncracies.

It remains now only to say a few words as to ammunition. As

regards the black powders of the three great firms, Messrs. Curtis and Harvey, Messrs. Hall, and Messrs. Pigou, they are all excellent in their way, and practically one is no whit superior to another. There is little doubt, however, that in most guns the large grain powders, like No. 6, are the best; but for the 20-gauges No. 4 is quite large enough. The small grains have a tendency to scatter, and mav be used for this purpose with effect. Of the Schultze wood powder I think it difficult to speak too highly. There is one hint, however, I would throw out, and that is, that the wood powder is greatly improved by keeping. My practice has for long been to lay in my stock of it one season for use in the next, and so keep it over the year before it is used; but I always test it for weight and strength as soon as I get it. The quality that it most gets by keeping is regularity in its action. Wild shots are very rare with powder thus kept, and its strength does not in the least diminish. I have now some powder by me ten years old or more, as strong as the first day I tried it, and in every respect the better for the keeping.

Nothing is said here of the old soft shot, as I should imagine no one who has experimented a single quarter of an hour would ever think of using it, except in a case of dire necessity, when no other could be got. Of the Newcastle chilled shot, and Lane and Nesham's hard, both appear to be equally good; but there is a difference in the count, which at times becomes a factor in the calculations when close experiments are tried, inasmuch as they are sufficient to affect the patterns obtained, the shot larger than No. 6 counting more to the ounce, while those smaller are considerably fewer, as will be seen by referring to the table of loads above given.

Wadding also demands a due amount of attention. Any that is soft and loose in texture, and has a tendency to blow to pieces or spread with the explosion, should be carefully avoided, as the best of a gun is never got with such. The pink edge are generally good, but the thick felt vary very much; they should be firm and solid, so much so that when picked up they will do to use again. This is really a good test of thoroughly good wadding. The card wadding before referred to and recommended should be of two distinct kinds—one to go next the powder, of very stout card, and as tight as can possibly be got into the shell without bulging it. This, however, may be dispensed with without doing much harm, provided one side of the pink edge is the black-varnished grease-

proof to go next the powder, and is an equally tight fit—supposing the space is wanted to get in the load required; but if there is room for it, it is better to use the card first. The other card wads should be as thin as possible, and just an easy or slack fit in the case; these are to be used above and below the shot. If they will just prevent the shot from falling out before the case is turned over, they are tight enough. But when loading to obtain spread for short distances, the strong, stout, tight-fitting card wads should be used at all times, both next the powder and under and over the shot, and the pink-edge over the sawdust (to fill up) as before described as well. And here again it must be mentioned that though, as a rule, the above formula of wadding answers extremely well, still guns are not unfrequently met with which like less, and some occasionally that will take some more with advantage. A good deal depends on the length of the cone between the chamber and the bore proper. Whatever this space is, it must be filled up by wadding of equal length between the powder and shot, to get good shooting.

It is now necessary to say why the approximate number of shot contained in each load has been given—viz., to enable anyone who likes to find out what pattern may be fairly expected from them at 40 and 60 yards. A considerable amount of time and labour has been bestowed in arriving at a reliable average of the patterns and force of guns of all three gauges. For this purpose none but perfectly trustworthy records have been employed—viz., those conducted by myself or under my control and direction in my presence, and those of the *Field* trials. In doing this, *full*-choke guns only have been included. All those under a certain figure have been discarded and considered as only modified chokes in each gauge, and the averages are obtained from the performance of some hundreds of barrels and several thousand shots. They stand as follows:

The 12-bores put on in round numbers two-thirds of the load, and penetrate 36 sheets of brown paper (Pettitt's) at 40 yards; and something less than one-third of the load and 14 papers at 60. The best of the class will put in about 7 per cent. more of the whole load of shot at 40 yards, and 2 per cent. at 60.

The 16-bores put in about three-fifths, and penetrate 35 papers at 40 yards; and two-sevenths and 14 papers at 60. The best of the class about 4½ per cent. more of the entire load of shot at 40 yards, and 1½ per cent. at 60.

The 20-bores put in about four-sevenths, and penetrate 34 papers at 40 yards; and two-ninths and 11 papers at 60. The best of the class about 5 per cent. more of the entire load of shot at 40 yards and 4 per cent at 60.

In point of fact, in all three classes the patterns are rather above the proportion here stated; but they are the nearest that can be obtained without going into fractions, and are close enough for practical purposes. It must be observed, too, that in either class guns are occasionally to be met with that show exceptionally good shooting, considerably exceeding the above calculations of pattern, but it is in most cases accompanied with a corresponding loss of force.

Nearly all the 20-bores—the memoranda of the shooting of which I have by me—have been shot with 1oz. of No. 6, consequently these only have been used in arriving at the above averages; but the recoil in these light guns with this load is heavy, often unpleasant, and it is thought that seven-eighths is better for general use—indeed several of the guns using this load are level with the others in both pattern and force. It will be seen then that the above calculations are based on trials made with $1\frac{1}{8}$oz., No. 6 hard shot in the 12-bores, and 1oz. in the 16's and 20's, and that there is no sort of analogy or uniformity in the relative percentages of what the best guns of the three classes do; but so the figures have worked out, and it is difficult to find a reason or to account for it, I therefore give them as they stand. And no fractions whatever are taken into consideration; these are very proper and right in a competition trial, but to a practical sportsman are useless.

In trials with the various loads of the different-sized shot as suggested in the tables, it will be found that the above average proportions will be pretty usually nearly carried out, so that an approximate guess can be made as to the result to be expected (approximate for this reason also, that with the larger shot, a slightly larger proportion, and with shot smaller than No. 6, a smaller one of the whole charge, will be put on). For instance, take the load of $2\frac{3}{4}$drs. and $1\frac{3}{8}$oz. No. 4, with an average-shooting 12-bore, and it may be expected to put on an average of about 146 at 40 yards, and 73 at 60 with Newcastle chilled shot, and 158 at 40 yards, and 79 at 60 with Lane and Nesham's hard shot—the one counting only 220 to the load, the other 237. The 30-in. circle is at all times intended, in speaking of what a gun puts on.

Mr. W. W. Greener was, I think, the first to publicly call atten-

tion to the remarkable effect produced on the patterns of chokes by a small addition to the load of shot. He says at page 172 of his excellent book on "Choke-bore Guns:" "We have repeatedly noticed that by increasing the charge of shot, by even twenty pellets, the wonderful increase of pattern it will make on the target, sometimes thirty to forty increase inside the circle with a further increase outside." This I can fully confirm, though not to so great an extent, but the result is pretty constant. It has been brought forcibly to my notice lately in the 12-bore gun building for me by Mr. Greener with the Marshall and Co. Damascus iron 25in. barrels, sent up soft for trial. This gun, with $1\frac{1}{8}$oz. No. 4, averaged 104; by adding a $\frac{1}{4}$oz. more shot the average went up to 159—an increase of 55 in pattern, and *thirteen more* pellets than are contained in the addition put into the gun. Again, I have lately had sent me for trial a pair of guns made by Mr. Rosson, of Derby, 30in. 12-bores, weighing only 6lb. 5oz., and remarkable for their low price (only 27*l.* 4*s.* the pair). They are thoroughly sound and good, though of course plain guns, and as handy as need be, and are certainly about the best shooting *pair* of guns I have tried for several seasons, the shooting being so very hard, even, and regular. With 3drs. of Schultze and $1\frac{1}{8}$oz. No. 6 the average was 203; with $1\frac{3}{16}$oz. it went up to 215, and with $1\frac{1}{4}$oz. to 239. These shots were really splendid—a jack snipe would hardly have escaped in one of them. I regret I did not try these guns with larger shot. Two other guns I have just shot, both 12-bores, made by Messrs. Weston, of Brighton, another provincial firm who turn out guns so good that they would be a credit to any maker. One belongs to a personal friend, a hammerless gun; the other a C.F., rebounding locks, taken from their stock for the purpose of trial. Both these guns are very light and handy and make tiptop patterns, and, I *think*, shoot the hardest of any guns I ever saw, but I cannot be absolutely certain of this without the test of the *Field* force gauge. The hammerless gave an average of 132 with $1\frac{1}{8}$oz. of No. 4 and 170 with $1\frac{3}{8}$oz.; the other gun 166 with $1\frac{1}{8}$oz. No. 4 and 181 with $1\frac{3}{8}$oz. This is extraordinary shooting for 40 measured yards. Both guns were loaded with $2\frac{3}{4}$drs. of wood powder, wadded as above suggested, and no difference was *felt* in recoil with the increased load. These examples are thought quite sufficient to support the theory of the advantages of increasing the weight of load with the larger sizes of shot.

"ONE WHO HAS FIRED SOME 20,000 TRIAL SHOTS AT MARKS."

# CHAPTER XIV.

## EFFECTS OF BURSTING STRAIN ON GUN BARRELS.

No entirely reliable experiments have been published of the strain which barrels of the various kinds made will bear without injury. The first proof charge is from 3 to 4 times the ordinary sporting charge, and it is considered that this meets all the requirements to enforce safety, even allowing for the reduction subsequently made in the metal. Mr. Greener, in his book on the Gun, has recorded an experiment in which he reduced the weakest part (that between bore and cartridge chamber) of a 12-bore barrel to ·05 inch thick, when it bulged but did not burst with 3¼drs. black powder and 1¼oz. shot. This barrel at 6 inches from the breech was only $\frac{1}{48}$in. thick, or about 5 times the thickness at the cone, but it did not bulge. Another barrel of the same substance at 6 inches from the breech, but stouter in the cone, was burst at the former part with 42grs. Schultze powder and 1⅛oz. shot, indicating that a greater strain is made on the breech end of the barrel by Schultze powder than by even a slightly increased charge of black powder—3¼drs. of the latter corresponding with 45½grs. of the Schultze powder. Beyond 9 inches from the breech the strain on explosion is greatly reduced, and Mr. Greener states that a barrel reduced in its fore part (from 17 to 25 inches from the breech) did not burst when fired repeatedly with the usual charge. He also shows that barrels open longitudinally much more readily than transversely, in

the proportion of 45 longitudinally to 8 transversely, according to his experiment.

In choke-bored guns there is a tendency to bulge behind the muzzle where the metal is most cut away by the choke-bore bit. For this reason these guns are obliged to be made stouter, and therefore heavier forward, than cylinders.

It is commonly supposed that snow, or a wad left in the muzzle of a gun will càuse it to burst, but I agree with Mr. Greener that such a result will not happen from a stoppage in that part more probably than if a similar stoppage exists in the middle of the bore. I have repeated his experiment to prove this fact, and found the same result to occur.

Of the comparative resistance to bursting charges afforded by different forms of iron and steel we know nothing with certainty, those which have been made and published appearing to have been conducted with a foregone conclusion.* Sportsmen may, however, depend upon the sufficiency of the proof charge in all cases where no subsequent reduction of metal has been made, but I am satisfied that the reboring for the "Perfect" cases recently practised by Mr. Ford is attended with considerable danger—independently of its being contrary to the Proof Act as amended in 1875. The following note appended by me to a letter of a correspondent in the *Field* of September 23rd, 1882, who had advocated the use of Mr. Ford's plan, sets this matter in a clear light. and I therefore reproduce it *in extenso.*

We are sorry to be obliged still to differ from our valued correspondent; but it is not merely a difference of opinion—it is a matter of law as well as of fact. The Gun Barrel Proof Act, 1868, was, in consequence of the introduction of choke-bores, modified in 1875 by new regulations applicable to barrels that were made

* An interesting experiment on the bursting strain of Damascus as compared with steel, recently carried out by Messrs. P. Webley and Co., will be found in the appendix.

larger behind than at the muzzle. Sect. 1 says that, as regards the construction of this law, "the expression 'choke-bored barrels' means barrels whereof the diameter of the bore at the muzzle is less than the diameter of the bore at *some point behind the muzzle, other than the chamber or recess which contains the cartridge.*" Sect. 5 states that in the proof of such barrels (for which No. 6 soft shot is to be used instead of solid ball), the charge shall be according to the scale set forth in schedule B, "*taking the diameter of the bore at its widest part.* exclusive of the chamber or recess containing the cartridge." Subsequent sections provide that when barrels are altered so as to come within the above definition, they shall be subjected to further definite proof, and be re-marked—the size of the bore at the breech and at the muzzle being both given. "One who has Fired" says that his gun bears the proof-mark "17;" consequently it will have been proved with $10\frac{3}{4}$drs. in its first proof, and with $6\frac{3}{4}$drs. in its definite proof—such being the charges prescribed by the Act for 17-bores, the diameter of which is given in the schedule as ·649. The bore of our correspondent's gun has now been enlarged at the breech end of the barrel to suit a No. 16 "Perfect" cartridge, the normal bore being left unaltered in the middle and fore-part of the barrel: it consequently comes within the definition in sect. 1, "the diameter of the bore at the muzzle being less than the diameter of the bore at some point behind the muzzle." By the diagrams we published a fortnight ago it was shown that the internal diameter of the No. 16 "Perfect" shell is ·710; and the Act says that ·710 is the diameter of a 13-bore. Accordingly, if the law were complied with, the altered gun would undergo a new definitive proof with the charge prescribed for "the diameter of the bore at its widest part," which is laid down in the schedule as $7\frac{1}{2}$drs. for a diameter of ·710, or 13-bore—the first proof with 12drs. being dispensed with. When the gun has undergone the new proof, it would be re-marked with a double number, as 13 B—17 M, indicating that it is 13-bore at the breech and 17-bore at the muzzle. The cone of a chamber is usually from $\frac{3}{8}$in. to $\frac{1}{2}$in. in length, and the measurement for proof is taken at the end of that cone; but Mr. Ford's boring must of necessity extend to a much greater distance up the barrel, since he has to connect a diameter of ·710in. (the inside of the case) with a diameter of ·649in. (the inside of the barrel); that is to say, a difference of ·061in., or about $\frac{1}{16}$ of an inch. Now, the barrel of a light 16-bore, such as our correspondent always uses, is about

·130in. in thickness at that part—indeed, many are even thinner; and to reduce this by ·030in. (or $\frac{1}{32}$ of an inch) is to cut away very nearly one-quarter of the substance—which even "One who has Fired" must admit is fraught with danger. The more we examine into this proceeding of Mr. Ford the more horrified we are at it. We will not contrast his plan with that of Mr. Jones, because they will not bear comparison—for one is of a high order of merit, while the other is quite the reverse. As to the eating away of the screw, who ever heard of a muzzleloader's breech screw being eaten away? and yet it is precisely like that of Mr. Jones, except that the latter is more completely protected from the gas than the former. We have recently carefully examined Mr. Jones's bushing tools, and seen more of his work, and we are quite content to stake our reputation on the success of the plan. It is, in our opinion, excellent in conception and carried out into practice in a most workmanlike manner. We have shown above that Mr. Ford's boring out must be to the extent of $\frac{1}{32}$ of an inch or thereabouts, which our correspondent compares with the removal of honeycomb. Did he ever measure the depth of a honeycomb? We trow not, or he would not compare the two processes, for a cut of ·003in. will take out as deep a one as is often seen.—Ed.

Since writing the above I have further investigated the matter, and have come to the conclusion that the question is simply whether the sportsman will be satisfied with paper or not; and if the latter, whether he will go to the expense of new barrels, or have recourse to the rebushing process? The new barrels are of course to be preferred, irrespective of the cost; but with their aid the sportsman can use his gun with either paper or metal.

# CHAPTER XV.

## CLEANING AND REPAIRING GUNS.

### SECTION I.

#### Gun Cleaning.

On first returning from shooting, a gun should not be touched inside, but should be carefully wiped outside and oiled with vaseline afterwards. Next morning the fouling will have absorbed water enough to render it easily removable with a "turk's head" or a cleaning rod armed with tow, but if the barrels are leaded something more is necessary. Unless the quantity of lead deposited is great, it may be removed by simple friction with a tight boss of tow or cotton charged with spirit of turpentine and followed by vaseline, but it generally requires a brass (not steel) scratch brush. Where rust has been allowed to be developed, this brush must also be used, followed as before by turpentine and vaseline.

The "honeycomb" sometimes seen in barrels is, I believe, caused by the galvanic action set up between the deposited lead and the iron of the barrel, and developed by moisture. The honeycomb is generally most prevalent at the "opening behind," connecting the cone of the chamber with the true bore, where "leading" chiefly occurs without being seen and removed. When it takes place at the muzzle, it is more frequently at once detected and removed. It is well known that

when two metals having an unequal affinity for oxygen are exposed to moist air, that which has the greater affinity suffers more from oxidation than if exposed by itself. Galvanised iron, for instance, when the zinc is worn off, rusts at that part more rapidly than plain iron, and a hole is developed. On this subject, however, I have consulted, as before, Mr. Woodland Toms, whose opinion is conveyed in the following letter:

Great advances in our knowledge of the decomposition of gunpowder have been made recently. The substance that is concerned in corroding gun barrels appears, from the investigation of Dr. Debus, F.R.S. on the "Chemical Theory of Gunpowder" (Bakerian Lecture to Royal Society, Feb. 23, 1882), to be potassic disulphide. This substance attacks iron most readily at high temperatures, consequently we should expect to find its action most pronounced at the narrowing of the chamber and the choked part of the bore, for those places would probably be most warmed by friction, and there also, the gases, being suddenly compressed, would evolve additional heat. Doubtless, also, the solid products of combustion would, like the particles of lead, be most likely to lodge in the constricted parts of the gun barrel, and, consequently, would be left to prolong their action in the cold. It appears that this potassic disulphide absorbs oxygen very readily from the air, giving out heat (sufficient, if large quantities be taken, to set fire to paper) and forming potassic hyposulphite, and liberating at the same time sulphydric acid gas. Considerable confusion has arisen from overlooking these facts.

As to the corrosion of gun barrels in the cold, I am inclined to believe with you that while the barrel remains moist and uncleaned, the "leaded" part of the barrel is very likely to be the seat of galvanic action. I do not, however, think that the pure lead would cause increased corrosion of the iron, for it is more electropositive than iron, and consequently should be attacked first. Shot are, however, plumbagoed externally, and contain antimony, and these substances are more electro-negative than iron, and likely, when in contact with that metal, to set up electric currents from which the iron would probably suffer.

The "leading" of the barrel at the choke and the cone is probably purely mechanical. Gun barrels are often magnetic from

constant hammering, and these magnetic properties would of course be most strongly developed at the two extremes of the barrel; but I need hardly say that lead is not attracted by a magnet.

F. Woodland Toms, F.C.S.

But whatever may be the cause, there is no doubt that in the choke-bore "leading" occurs very generally, and, when putting guns away at the end of the season, great care should be taken to remove it, as well as fouling and rust. When quite clean, brush in plenty of vaseline, and then cork tightly (a wad is comparatively useless), or insert the sticks sold for the purpose by all gunmakers. Afterwards remove the locks, clean if necessary, and dress with gunmaker's oil, which is refined neatsfoot. Replace locks, remove all damp from contact of the hands with the barrels, and then dress the outside with vaseline. Great care should be taken to keep all guns in a dry room. In hammerless guns, the cocking parts should be carefully cleaned and oiled with vaseline, which is too sticky for the locks. The tumblers should be let down to relieve the springs by pulling the triggers.

The stocks may be rubbed with linseed oil in small quantities.

Different guns require different modes of taking the locks apart; but this should never be attempted without demonstration by the gunmaker from whom the gun is obtained. The Anson and Deeley requires a special cramp for this purpose; but Mr. Greener's latest improvement has a little catch on the mainspring which renders a cramp unnecessary, and it may be taken to pieces by any handy person with the aid only of a small turnscrew.

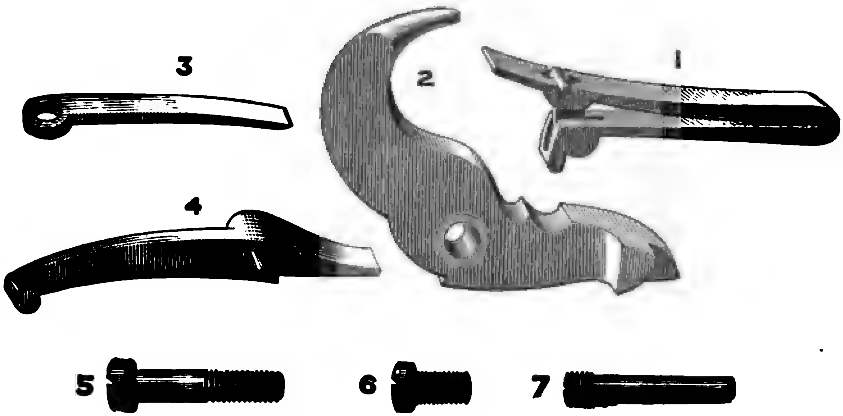
The following is his description of this lock:—

### Mr. Greener's Adjustable Lock Mechanism.

In hammerless guns having the lock mechanism arranged and fitted in slots in the breech action body, instead of being

affixed to lock plates, it has always been difficult to remove the same for cleaning or inspection. Special tools are requisite, and experience wanted to cramp the mainspring and fit it into its place again.

The Greener patent adjustable mainspring and lock mechanism is capable of being taken apart and put together by the merest tyro with an ordinary turnscrew; the mainspring (1) is kept constantly cramped by the swivel, as shown below.




GREENER'S ADJUSTABLE LOCK MECHANISM.

In taking the gun to pieces, having first removed the cover-plate, proceed in the following order: Turn out the scear spring screw 6, the spring (3) will then fall out on pulling the trigger; turn out the scear pivot (7), and, lifting the scear nose with the turnscrew, withdraw the scear (4); take out the tumbler pivot 5, reverse the gun and the tumbler (2) and main-spring (1) will fall out. In putting together reverse the order. No force is required of any kind, but care must be taken when replacing the scear to place the tail in notch in trigger blade, when if the trigger is pulled the scear will readily fall into its place.

When the gun is cocked, the mainspring (1) is still further

cramped, and when released expands till arrested by the swivel coupling. The momentum given to the tumbler is sufficient to strike off the cap, after which, by reason of the greater weight of the tumbler being in rear of the pivot, the tumbler rebounds or falls back from the face of the breech-action, the points of the strikers not projecting through to foul the caps, cartridge cases, or extractor. All the mechanism works on the two pivots, as shown, and is exceedingly simple.

In Messrs. Scott's gun great care should be taken before putting it by for the summer to oil the cocking rod, which may otherwise become set, and the hooks would then be injured on opening it.

All side locks may be cleaned and oiled without taking their "limbs" apart, by the aid of small penny brushes, one for removing dirt and the other for the oil. The limbs of the Anson and Deeley and Greener locks, however, are not so easily reached, and to get at them, if dirty, they must be removed. Their position below and before the strikers, however, renders them more safe from the attacks of gas, but water can reach them in inverse proportion, especially in the case of the Anson and Deeley.

## SECTION II.

### Repairing Guns.

The chief repairs necessary in guns are—1st, in the facing of the breeches; 2nd, in the locks; 3rd, in the boring; and 4th, in the browning.

1st. When a gun shows a space between its barrels and break-off without being loose there when closed, no notice need be taken, as it is quite as safe as ever, and the vacant space is only caused by the carelessness or officiousness of a

keeper or other servant, who has perhaps used silver sand, as I have often known done to the breeches and break-off. If, however, the bolts are actually loose the gun should at once be placed in a gunmaker's hands (the vendor for choice), who will generally be able to restore it to a sound state. Some guns are more easily repaired in this way than others, and notably those furnished only with the Purdey bolt, without top connection of any kind. These have only to be fitted with a larger bolt and they are as sound as ever, even if the faces do not touch; but it is usual in addition to "face them up" by taking out the hinge bolts, cramping the breeches and break-off together, and in this condition grinding in a smaller and slightly larger bolt. But this cannot be done where there is a doll's head, because, if the bearing is on the fore part of this extension, the more it is "faced up" the more useless it becomes. Hence Mr. Purdey altogether objects to the "doll's head," and in fact to any top extension which will interfere with facing up; and his example is followed by several other London makers. Naturally enough, if a customer pays a top price for a gun, he expects it to last several seasons, and, as Mr. Purdey's customers are chiefly composed of heavy battue shooters and grouse or partridge drivers, his guns wear out more rapidly than those belonging to gentlemen whose opportunities are not so "rosy," as will generally be considered. Moreover, the guns of the former class are more often attended to by keepers or valets than those of the latter, a large proportion of whom see to them themselves. For these several reasons I can readily understand why Mr. Purdey objects to all top connections, and, even with his bar locks, depends on the good metal and workmanship of his guns, simply aided by his own bolts. Without doubt he is safe enough under these conditions, but, as I have elsewhere remarked, purchasers of cheap guns must

remember that they cannot be equally developed in them. The Westley-Richards gun, with or without the Anson and Deeley lock, is on the other hand quite incapable of being "faced up," not only from its doll's head, but from its hinge bolt, which is cut out of the solid; and though it is possible to replace it, this is done at a considerable sacrifice of strength, the bearing being very small at each end. Mr. Greener's top extension admits of facing up with a new bolt inserted in it, or of a new bolt without "facing up"—the latter being impracticable without a new hinge bolt, which can, however, be added in his improved action, in which the cocking lever does not interfere with the ordinary hinge bolt. In Messrs. Rigby and Bissell's hammerless gun, although there is a top connection, facing up is easily accomplished, both the hinge bolt and top bolt being readily renewed. Indeed, I know no gun more susceptible of repairs than this, though from the strength of the action, if properly treated, it ought to wear a long time, even in heavy work, without requiring them. All other guns not having a doll's head are capable of being faced up.

2nd. The locks, if originally good, ought seldom to require repairs; but the best work will sometimes give way, and in that case an efficient gunmaker should be consulted, and the task of repair committed to him.

3rd. Choke-boring has been shown to be very lasting; but in those guns which are shot 4000 or 5000 times a year, the choke will wear away more or less in the course of time. In that case the "regulator" of an efficient gunmaker can restore the choke to its proper state without risk to the gun, the extra cut being probably not more than ·005 inch.

4th. When the barrels have become bare from exposure to wet, followed by neglect and rust which is afterwards removed by friction, re-browning may be had recourse to at the cost of

a few shillings. The colour of case-hardening sometimes goes from neglect and abuse; but no attempt to restore it should be made by a second case-hardening.

Sometimes the springs of the striker break, in which case new ones can easily be added, as also in the case of main-springs whether flat or spiral.

A great deal of the wearing away of the breech, by which "facing up" is necessitated, is caused by the dimensions of the ordinary gun case, which compel the gun to be taken to pieces before putting it away. In my opinion, it would be far better to sacrifice the case to the gun, rather than the gun to the case, as is now done. At present, the length of the gun case is determined by that of the barrels (say 30 inches inside), but if the case is made 45 inches long inside, the gun may be deposited in it without exposing the breeches to injury from the carelessness or officiousness of an ignorant keeper or other servant. This has long been done with match rifles, and the plan might very easily be extended to shot guns, as the full-length case would still easily go under the seat of a railway carriage.

# BOOK II.

# SHOT GUNS USED WITH THE PUNT.

## CHAPTER I.

### SECTION I.

#### GENERAL REMARKS ON THE OBJECTS OF THE WILDFOWLER.

BETWEEN game shooting and wildfowling there are distinct principles to be followed out which are somewhat conflicting, but which will be more readily understood when the conditions of each sport are carefully investigated. In the pursuit of game the sportsman always has to remember that, if he lets a certain number of the stock on his ground escape his aim, he will in all probability have another opportunity of attacking them; they are still his property whether alive or dead, and if allowed to get away will live (to fight for their lives by flight) another day. The wildfowler, on the contrary, has no property in the fowl he works up to, and if they escape him to-day he will very likely never get another shot at them. Hence two different lines of proceeding are laid down for the conduct of the two kinds of sport. On the one hand, the game shot is not considered sportsmanlike if he uses a gun with a larger bore than 12, or if he shoots "into the brown," as it is called; while, on the other, the wildfowler may, without any risk of condemnation, use a small cannon if he likes, and as many really do; while the main object of his pursuit is to

bring down as many birds at one shot as possible. These points of difference must always be held in view, whether in considering the sport of wildfowling, or the guns by which it is carried on. The latter are, 1st, large punt-guns attached to the punt itself; 2nd, heavy shoulder guns of 8 or 4 bore; and, 3rd, 12-bore cripple guns for finishing the birds crippled and wounded by the act of firing into the middle of the flock.

## SECTION II.

### Punt Guns.

Of late years the novice in wildfowling must have been in a somewhat perplexed state of mind on reading the many very opposite opinions given, not only upon the merits of muzzle-loaders *versus* breechloaders, choke bores *versus* cylinders, &c.; but upon the various plans of taking up the recoil of these heavy guns, the best lines for building punts, &c. It is quite curious to see how puntsmen of large and varied experience will differ from one another in these matters, far more, perhaps, than any other set of sportsmen. With respect to muzzleloaders *versus* breechloaders, I think that this controversy has been finally settled in favour of the more convenient breechloader, as was certain to be the case. It would have said little for the skill and ingenuity of our gunmakers if they could not have made breechloaders as safe to use, and to shoot as well, as muzzleloaders.

The difficulty experienced in loading the muzzleloader while in a horizontal position is alone enough to condemn it, if its rival can be built to equal it in its shooting powers; and that it will do so if properly made is now generally admitted. I shall, therefore, in the following remarks entirely omit all consideration of the muzzleloader: first, because its use is now

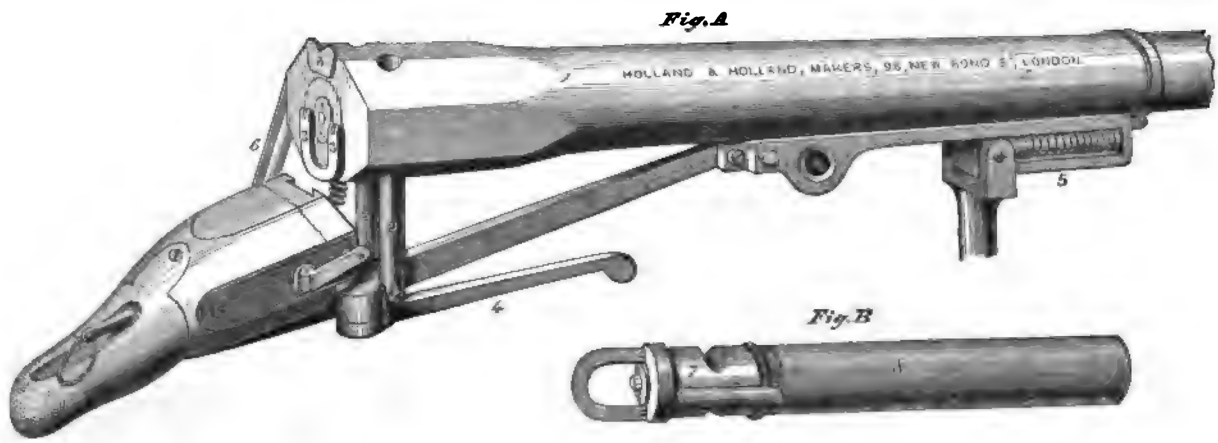
out of the question if the price of a breechloader can be raised; and, secondly, because its construction is so simple as to require no description, although practically it may demand as much skill as the breechloader to produce an efficient piece.

In the following observations I may remark that, having no personal experience of the sport, I can only follow the lines laid down by the various correspondents of the *Field*, the columns of which journal have been largely occupied of late years by the admirers of this sport, which has during that time, perhaps, made greater strides in popular favour than any other kind.

In considering the breechloading punt gun, it is admitted that there are four chief requirements to be attended to:

1. Safety as depending on the strength of the action and of the breech end of the barrels.
2. Its shooting powers.
3. Facility of loading by means of the cartridge.
4. The ready and easy extraction of the exploded cartridge cases.

Among those gunmakers who have devoted themselves to the task of producing a really available punt gun, I may include the following: viz., Messrs. Holland and Holland, of London; Messrs. J. and W. Tolley, of Birmingham and London; Mr. Patstone, of Southampton; and Messrs. Moore and Grey, of London. Many other gunmakers have, like Mr. Greener, adopted the ordinary double grip or wedge-fast actions, similar to those used for shoulder guns; but they are said by wildfowlers of experience not to stand the salt water and heavy strains to which they are subjected. Nevertheless, as they are still approved of by a considerable number of those who delight in punts, I shall include the whole of those he recommends, after giving a description of the plans recommended by the above well-known firms.




MESSRS. HOLLAND AND HOLLAND'S STEEL BARRELLED HAMMERLESS PUNT GUN, "THE LONDON."

Length, 8ft. 6in.; Weight, 100lb.; Bore, 1¾in.

Fig. A., 1. Steel barrelled gun, open, showing the extractor.
2. Circular steel rods passing through the breech end of the barrels and the extractor.
3, 3. Extractor handle.
4. Lever.

Fig. A., 5. Colonel Hawker's recoil frame, with loop for a rope attached.
6. Side bar to prevent the stock falling too low.

Fig. B., 7. Extractor, with 8, cartridge in the clips ready for inserting in the gun.

## MESSRS. HOLLAND AND HOLLAND'S PUNT GUN, "THE LONDON."

This firm appears to have succeeded in throwing all their competitors into the shade by the invention of their new punt gun some few years ago, which they have appropriately named "The London," as it is really invented, bored, and actioned in the metropolis, being, I believe, the only instance of gun-barrel boring at present carried on out of Birmingham. At first their barrels were made of iron, but the firm have at length succeeded in making them out of steel, which is of that description termed "mild," and is made in Sheffield and sent up to London in a solid block. The barrel is then bored out of the solid, and the whole gun actioned and made in London.

The advantages claimed for a steel barrel are, firstly, its increased strength and lightness; and, secondly, its giving better shooting, both in regularity and closeness of pattern and increased penetration. It was always very difficult to get the iron barrels free from flaws, and, in consequence of the difficulty in "setting" them after they were welded, they were very rarely really straight; hence the complaints often made of their not shooting as regularly and as "hard" as they should have done. The steel barrels, on the other hand, are drilled from the solid in a particular manner with very powerful machinery, and are perfectly straight; and those shown to me by Messrs. Holland had a polish inside like that in a highly finished 12-bore gun.

1st. *As to Safety.*—The breech-action (Fig. A, page 412) is constructed so that no part of the recoil comes upon the stock at all, but is taken up by the two round steel rods (2, 2) which shut up through half-round slots, one on each side of the extractor (see Fig. B 7), the other halves being cut in the breech end of the gun, so that all the strain comes eventually upon the breech of the gun-barrel itself.

As a test of the great strength of the action, I am told that the guns are sent to the proof-house in the finished state, so that the actions as they are when used by sportsmen stand first and second proof. But the mechanism proves itself.

Messrs. Holland showed me two very large guns, 2in. bore, which they had just had proved; one was for use in the bow of a steam launch, and the other was for a double-handed punt. They had both stood the following heavy charges, and were proof-marked accordingly:

| | | |
|---|---|---|
| 1st proof. | Charge, | 18¾oz. powder. |
| | ,, | 26oz. lead plug. |
| 2nd proof. | Charge, | 13¼oz. powder. |
| | ,, | 26oz. lead plug. |

The breech end of the gun is made very stout at its extreme end; this is not so much for safety as to absorb recoil, and also has the advantage of causing the gun to balance well out board, and thus gives the punter more room in the punt.

2nd. *Shooting Powers.*—Perhaps no better test of the shooting powers of the "London" could be referred to than the trial made by Mr. E. T. Booth, some two years ago; the results were published in the columns of the *Field* at the time. Mr. Booth had a favourite muzzle-loading 1¼in. gun, which he had always considered a remarkably hard and close shooting one, and with which he had beaten many other guns, muzzle and breech loading, of the same bore.

This gun was pitted against one of Holland's 1¼in. "London" guns, and the trial was carried out by Mr. Booth himself. The guns being shot side by side at the same time, and loaded by Mr. Booth with the same charges. Range 100 yards; target of wood. In the result the breechloader beat the muzzle-loader, both in pattern and penetration, by about 12 or 15 per cent. This trial clearly shows that there is no reason, excepting

faulty construction, why a breechloader should not shoot as well as, or even better than, a muzzleloader.

3rd. *Ease of Loading.*—The action of the "London" is very simple. The lever being turned to the right, the stock falls and exposes the face of the breech end of the barrel. The cartridge being placed in the clips of the extractor is pushed into the barrel, the stock is then lifted up, and the lever turned home—when the gun is ready for firing.

4th. *The Extraction* is simple and certainly effective. Usually the empty case can be easily pulled out by the extractor, but should it stick, the head of the extractor (which has a strong quick thread upon it) can be turned, and this brings the empty cartridge out about half an inch, and relieves the case, so that it can be drawn out with one finger.

The gun shown in the engraving (page 412) is built to fire the paper case. These guns are also built upon the same principle to take either the steel or the brass case. Of course, when these latter are used, the breech end of the gun has to be chambered. The paper cases appear to be generally preferred. No doubt, if a paper cartridge gets very wet, and much knocked about, there may be some difficulty in loading; but, if the outsides are lightly coated with grease, there is not much fear of this accident, and they always extract with the greatest ease; but with the steel or brass cases there is often great difficulty with the extraction, and they sometimes split up, causing a great escape of gas. There is also some difficulty in keeping the shot wad in. As a rule the ends of the metal cases have a number of small indentations to keep the wad in its place, but it is often found that, in carelessly carrying the loaded cartridges, the heavy charge of shot (16oz. to 32oz.) used in these guns will loosen the wad, and thus allow the shot to escape. But it is easy to avoid this risk by fitting the cartridge box with wooden discs projecting into the open mouths of the cartridges.

### Mr. Patstone's Punt Gun.

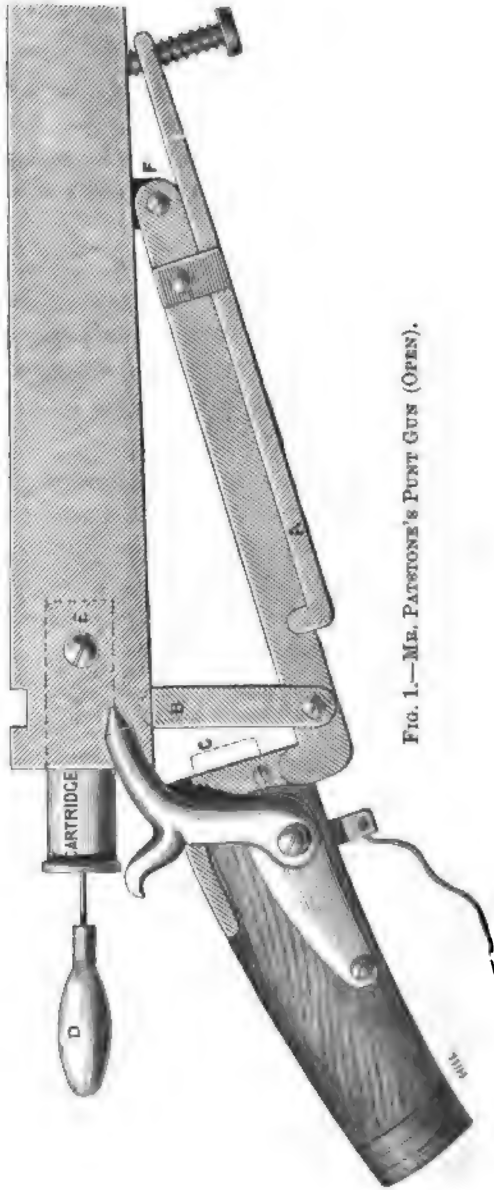



Fig. 1.—Mr. Patstone's Punt Gun (Open).

This gun is the invention of Mr. Clayton, of Southampton (the predecessor of Mr. Patstone), aided by Capt. Morgan. It greatly resembles that of Messrs. Holland in principle, though very inferior in strength and in the plan for extracting the cartridge case. The annexed plan (Fig. 1) shows its construction, and also the means by which the empty case is extracted. It is exploded by a tube, which is inserted at E, and the recoil is taken by the rods B, together with the hinge joint F, aided by Captain Morgan's safety bar A. In this last arrangement there is no doubt a great similarity to the plan adopted by Messrs.

Holland and Holland, as will be seen by comparing it with the engraving of the "London" at page 412, the safety bars and recoil rods are alike in principle, differing in one respect, viz., that while in the "London" they lock the extractor block (Fig. B 7), in Mr. Patstone's gun they simply support the cartridge. This is rendered clear by examining Fig. 2, in which the slide B is shown in its place. But it is, as above remarked, in the extraction of the empty case that the "London" shows its superiority, and it is here that the breechloading gun usually fails. In Mr. Patstone's gun a separate tool (Fig. 1, D) is screwed into the base of the case, and extraction is performed by the unassisted power of the arm, but in the "London" the enormous additional force of the screw is added. A projection from the break off (see Fig. 2 C) also supports the bar. Mr Patstone's gun weighs 86lb.; length of barrel 8ft.; charge of powder 2½oz.

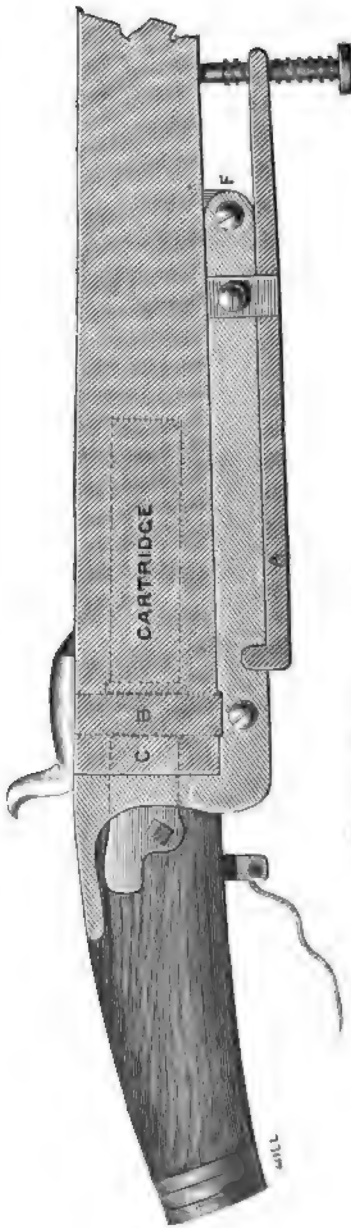



FIG. 2.—MR. PATSTONE'S PUNT GUN (CLOSED).

## Messrs. J. and W. Tolley's Snider Punt Gun.

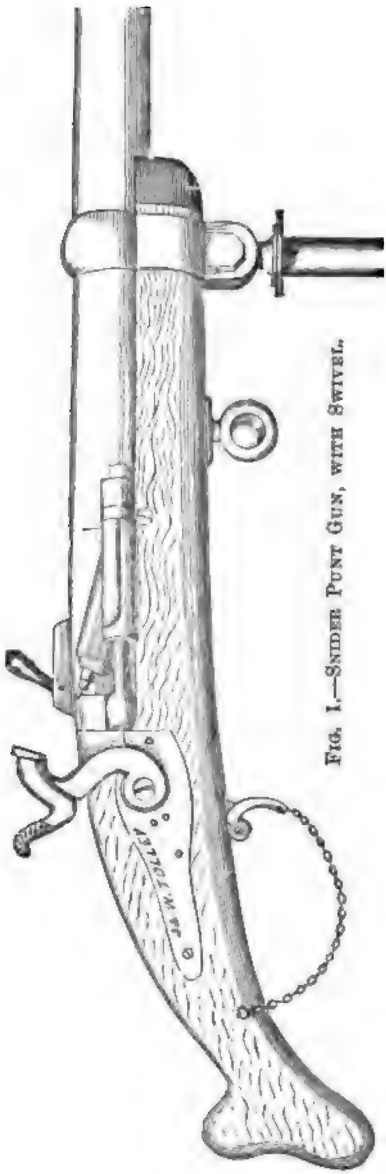




Fig. 1.—Snider Punt Gun, with Swivel.

The above firm make their small punt guns on the Snider principle as shown in the annexed plan (Fig. 1), with a simple swivel and breech-rope ring. The action is so well known that a description is scarcely necessary. It is generally admitted that the Snider action is simple, strong, and durable, and its only defect as applied to punt guns lies in the extractor. The breech is closed by a solid block of iron, which is hinged on a side bar, so that when the block is turned over sideways it is freed behind, and can travel on the bar for a considerable distance. But before this travel, it is brought into connection with the extractor, which it carries along with it, and thereby extracts the empty case. In the block is a striker, passing obliquely downwards and forwards, from the level of the hammer head to that of the centre of the barrel, where it comes into contact with the cap, when it receives the blow of the hammer at its posterior end.

MESSRS. J. AND W. TOLLEY'S SCREW-BREECH PUNT GUN.

In this plan the breech (Fig. 2 A) is entirely removed from the breech chamber, together with the empty case, which is held by two steel claws (see B in engraving). The cap in the cartridge is exploded by a rod in the centre of the breech A, by means of an ordinary hammer. The plan is so simple as to require no further explanation. The breech-pressure is entirely taken up by the screw, which, of course, is strong enough for the purpose. The prices of these guns are, for the Snider, 38*l.* to 54*l.*, according to bore. For the screw-breech (Fig. 2), of any bore, 65*l.*

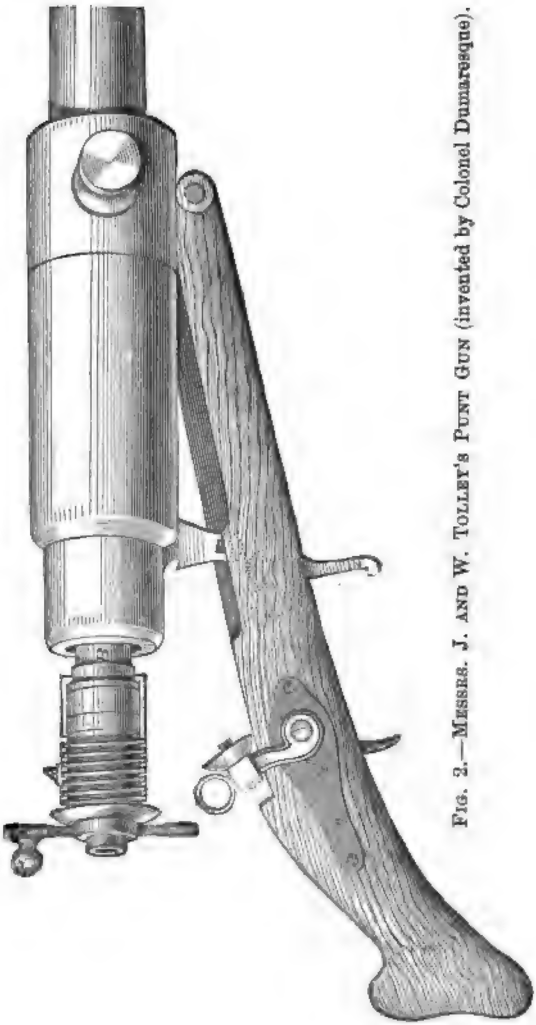


FIG. 2.—MESSRS. J. AND W. TOLLEY'S PUNT GUN (invented by Colonel Dumaresque).

## Moore and Grey's Punt Gun.

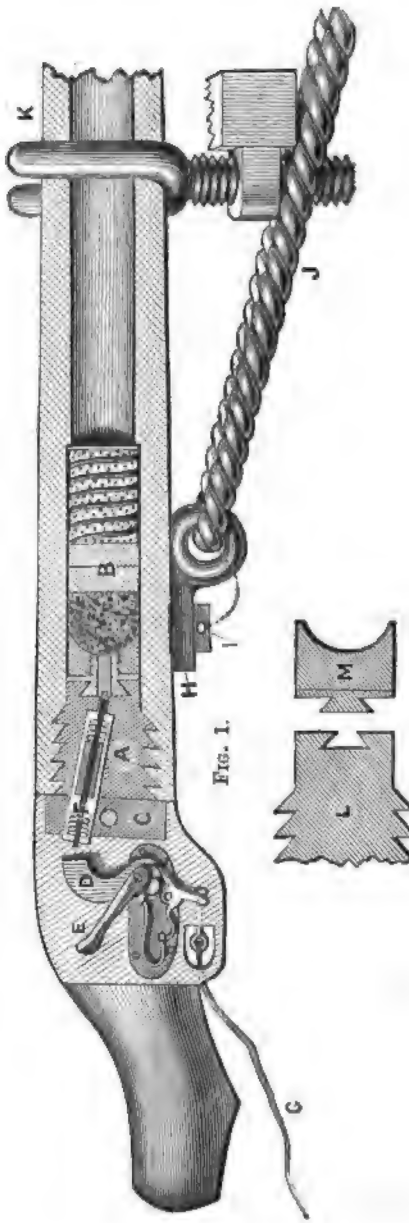



Fig. 1.

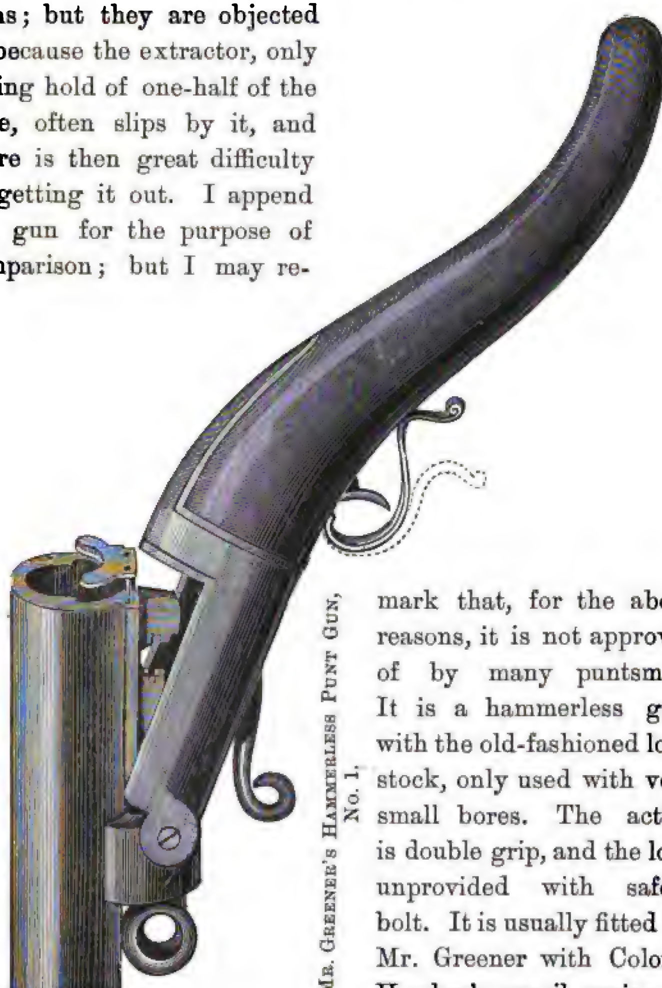
Fig. 2.

Moore and Grey's Punt Guns.

This gun greatly resembles that of Messrs. Tolley, having a screw breech like it, also extracting the case in the same manner, though the dovetail is smaller. Figs. 1 and 2, L A show the screw, with its female dovetail fitting the male, as shown at Fig. 2 M; B is the cartridge, with its shot in Moore and Grey's spiral wire; C is the hole in the plug for the insertion of the lever to unscrew it; D is the concealed tumbler, with outside lever E for cocking; F is the striker and spring; G, the firing line; H, breeching link and tackle (kept in place by the pin I); J, rope breeching; K, crutch. It will be seen that in all the guns hitherto described, the empty case is withdrawn by means of clips, except in regard to Messrs. Tolley's Snider, which on that account is only used for small guns.

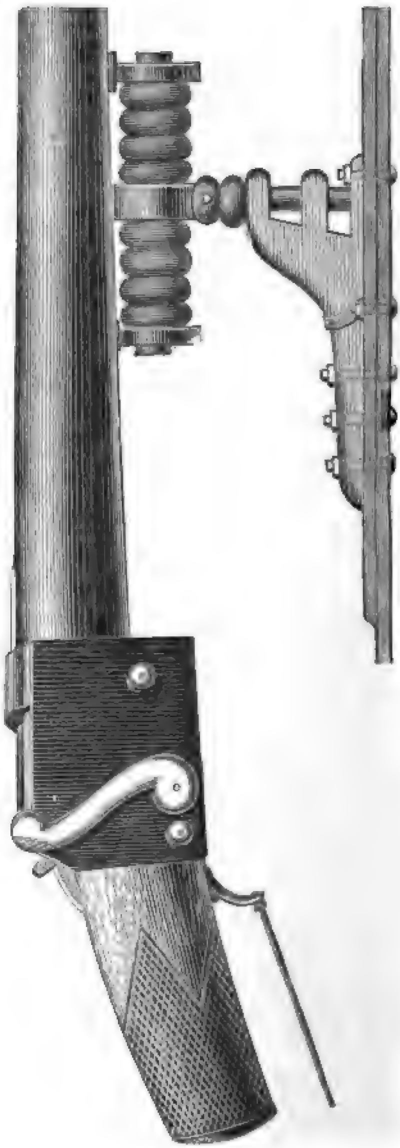
### Mr. Greener's Hammerless Punt Gun.

Mr. Greener, in common with many other makers, adopts the double-grip action and ordinary extractor for small punt guns; but they are objected to because the extractor, only laying hold of one-half of the case, often slips by it, and there is then great difficulty in getting it out. I append his gun for the purpose of comparison; but I may remark that, for the above reasons, it is not approved of by many puntsmen. It is a hammerless gun, with the old-fashioned long stock, only used with very small bores. The action is double grip, and the lock unprovided with safety bolt. It is usually fitted by Mr. Greener with Colonel Hawker's recoil spring in addition to the breeching ring, as shown in the engraving.



Mr. Greener's Hammerless Punt Gun, No. 1.

MR. GREENER'S "FIELD" PUNT GUN WITH INDIARUBBER RECOIL BREECHING.



MR. GREENER'S "FIELD" PUNT GUN, NO. 2.

Mr. Greener also uses the plan of Mr. Field's rifle, but it is said, like No. 1, to be open to the objection that the extractor is too weak for the purpose, though it answers well enough in rifles. The action is no doubt strong and simple enough, the block falling sideways like that of the Snider rifle. With this gun, also, he uses "Wildfowler's" indiarubber recoil breeching, which is now considered by puntsmen to be superior to Col. Hawker's well-known recoil spring, and is preferred by many to Mr. Booth's recoil apparatus described at page 425.

Mr. Greener's third plan for punt guns is described and illustrated on the next page. As in Nos. 1 and 2, the weak point here is in the extractor.

### Mr. Greener's Wedge-fast Punt Gun.


Mr. Greener's "Field" Punt Gun.

With this gun Mr. Greener adopts his wedge-fast action, but I have never known it used by any puntsman, so I can give no opinion even at secondhand on it. Its leading feature, as he describes it, is the top connection in addition to the usual double-grip fastening underneath the barrels. The top cross-bolt A is withdrawn by a small handle working a screw, which is, no doubt, sufficiently quick for a punt gun. The lock is back-actioned and rebounding, the tumbler being elongated, and striking a horizontal sliding plunger working in the face of the breech action, and firing the cap in the cartridge case. With this gun he prefers to use a solid brass 1½in. cartridge case.

## SECTION III.

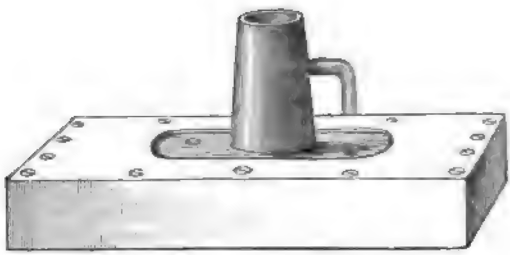
### Recoil Apparatus.

There are three methods of taking up the recoil which have preference over others, and are variously approved of by different puntsmen:

1st. *Rope Breeching.*—Perhaps no kind of breeching is superior to a good manilla rope, and most of the old punters preferred this to any other. It is so simple, light, and easily replaced and managed, that it is doubtful whether any other recoil apparatus will entirely supersede it. There are various ways of using the rope, but generally it is passed through a strong eye attached to the under part of the gun, or else attached to trunnions. In the former case the loop should be considerably larger than the rope, and the edges well rounded, so that the rope will not get frayed. It is desirable that the loop should be so attached that it can be easily taken off the gun, so as to leave it on the rope and allow the gun to be removed.

2nd. *Col. Hawker's Frame and Swivel.*—This, as shown at page 412, is too well known to require description. It was originally fitted to take a steel spring, and when a spring is found to stand no doubt it is a convenient form of recoil apparatus. But steel springs are not always to be depended upon; however, if it breaks there is no danger of the gun coming back to hurt the shooter. Instead of a spring, sometimes rubber buffers are used as recommended by "Wildfowler." In their case precaution must be taken to prevent their jamming one into the other; it is well to have one small buffer at the other side of the slide to take the second recoil. It is generally recommended that there shall be a loop for a rope as well as the Hawker recoil frame.

3rd. *Mr. Booth's recoil box,* as shown below. This is a combination of rope and buffer recoil apparatus. The gun swivel fits into the upright socket, which is attached to a strong piece of oak, running on six small wheels. This block is placed in a strong box about eight inches longer than the block; at either end of the box are rubber buffers about two and a half inches long, so that the block has a free run of about three inches. The box is firmly attached to the bottom of the punt. When used the block is run forward, and a rope is placed under the hook behind the socket, so that the recoil



MR. BOOTH'S RECOIL BOX.

is first taken up by the rope, and then what energy remains is taken by the back buffers, and the rebound by the front buffers. There can be no question of the security and convenience of this plan, and Mr. Booth, who has had great experience, and is a good authority upon all points connected with punting, considers it the best system which he has ever tried. There is not much strain upon the bottom of the punt, as, if the rope breeching is kept firmly taut, nearly all the recoil is taken up by the rope. These machines are very generally approved by puntsmen. They are made and supplied by Messrs. Holland and Holland from drawings given to them by Mr. Booth.

## SECTION IV.

### Ammunition used with Punt Guns.

With regard to the shooting powers of guns used with paper cases *versus* those for steel or brass shells, there has been a good deal of controversy. One of the objections made against the paper cases is, that the front portion which goes up with the shot causes the shot to ball; this is not at all proved; it is quite certain that it could not do so with a choked-bored gun, as the sudden contraction at the nose of the gun would be sufficient to break the case. Messrs. Holland informed me that, in all the hundreds of shots they have fired at targets with various bores, chokes and cylinders, from punt guns with paper cases, they have never had an instance of balling; but I have heard of guns, both muzzle and breechloaders, balling when fired with chilled shot. There is no doubt a greater tendency to balling with chilled than with ordinary shot. Paper cases should be made with strong metal lining at the base, but should not be thick in the paper part. They should be made of the very best hard paper, and should be slightly smeared with tallow or nicely varnished to protect them from damp. Oakum or felt wadding is generally used over the powder, putting a card wad under and over the same, and a couple of thin hard wads over the shot. Complaint is sometimes made that the felt wadding blows to pieces This must be when loaded with bad wadding. If best thick felt be used the wads should come out of the gun almost perfect, so much so that they could be used again. One of the faults with many of the paper cases is the smallness of the caps with which they are primed. There can be no reason why a cap some sizes larger than a military muzzle-loading cap should not be used, thus giving a greater flash and insuring the

ignition of the coarse powder. Many missfires have occurred through this defect. It is also always desirable to put about three drachms of fine grain powder at the bottom of the case before loading, and it is not a bad plan to put a thin piece of paper or gauze over the fine powder, so that if the cartridge gets much shaking the fine powder will not get mixed up with the coarse.

### Moore and Grey's Spiral Wires.

The above firm brought out, some few years ago, a spiral steel wire, intended to be used like the Eley wire-cartridges for increasing the range of guns. I have always considered them dangerous on land, and even on the water they ought to be used with great care, as they fly with the force of a ball, and about half as far. Some puntsmen use them and approve of them highly. The method of introducing them will be understood on reference to the engraving of Moore and Grey's punt gun at page 420.

### Black Powder.

As to powder, there are four chief kinds, which are sometimes used mixed:

1. A. T. P. (army town proof) is the smallest in grain, and is chiefly used in small guns.

2. T. S., No. 8 (treble strong) has a coarser grain, and is often mixed with A. T. P.

3. L. G. (large grain) is still coarser and stronger. Of course, it is more slow in ignition.

4. R. L. G. (rifle large grain). This is still larger, and is often used in small artillery guns. The Nos. 3 and 4 are used with large punt guns.

Schultze powder is not used for punt guns, being considered to be too quick in its ignition.

### Shot Used in Punt Guns.

The shot employed depends on the sport likely to be met with, the choice generally being between the various B.s (see page 339).

### Wadding.

The wadding generally used is tow or oakum, and the thickness depends greatly on the bore, varying from 1in. to 1½in. Mr. Greener advises even for his 1½in. case wads of felt 1in. thick. With the above shot large punt guns may be fairly relied on to kill at 120yds. With regard to charges, each shooter will have his own fancy after he has had some experience, but the tyro will do well at first to be guided by the maker of his gun.

# CHAPTER II.

## WILDFOWLING SHOULDER GUNS.

---

### SECTION I.

#### General Remarks.

Three gauges are used for this purpose, viz., Nos. 10, 8, and 4, the first-named being also occasionally used for game, and its load being therefore given at page 386. It is not generally approved of by wildfowlers, who prefer a double 8-bore, or a single 4-bore.

### SECTION II.

#### Hammerless 4-bore Shoulder Guns.

Of late these guns have been much approved of in the hammerless form, and I therefore commence with them.

#### Holland and Holland's Climax Hammerless 4-bore Single Duck Gun.

The accompanying block shows a single hammerless 4-bore, as made by the above firm; weight 15lb., length of barrels 42in., full choke bored, and constructed to shoot 10drs. powder, 3oz. to 3½oz. shot, according to size. The lock is made upon the same principle as their double-barrelled Climax gun, with the automatic safety block coming up in front of the striker; but, instead of the top spring lever, it has the double-grip

lever under the guard, as it is generally admitted that this action is better adapted for large-bored guns shooting very heavy charges. This arises from the grip lever having a squeezing and binding down power which cannot be obtained from any sort of lever which is worked by a spring. Further, it has the advantage of enabling the shooter to close the gun, even should there be any dirt or obstruction, or a tight cartridge, in which case the lever brings the barrels down with its screw action; whereas with a spring action, the grips being nearly square, it is necessary that the barrels should be quite closed on to the action, otherwise the bolt, or bolts, will not enter the grip. This applies to all kinds of spring-action guns more or less, and is fully recognised by wildfowl shooters,

HOLLANDS' 4-BORE SHOULDER GUN.

especially when they are shooting in a wet country, and are using paper shells. The gun shown is chambered to take the 4-bore brass shell, thus getting over the difficulty attending on the wet affecting the outsides of the paper. These brass shells have the further advantage of giving a larger bore, viz., a large 5-bore against a 6 with the paper case.

The stock is fitted with an extra thick recoil heel-plate (smoothed to prevent its catching and clinging to the shoulder when being mounted), and has a pistol grip, which is a great aid to shooting with these big guns, giving a much firmer hold to the right hand, especially when wet. The stock is made short and much bent, to prevent the recoil giving a blow to the face; it also enables the sportsman to use the gun more conveniently when in awkward positions, especially when in a boat.

This gun is guaranteed to kill at over 100 yards range. Lord Elcho, M.P., Mr. Alex. Hatfield, and others, wrote to the *Field*, in February, 1878, giving their experiences, and describing good shots at various ranges over 100 yards up to 150 yards with 4-bores made for them by Messrs. Holland and Holland. In a trial before me at Wimbledon in 1879, at the force gauge, we got a registered force of over 2·00 at a range of 100 yards, with B shot. This force is nearly up to the average of a 12-bore at 40 yards with No. 6 shot.

The lock-plate action and furniture are nickel plated, to prevent rust.

The barrel is so choked that either loose shot or cylindrical wire cartridges can be used. Messrs. Holland find that closer and much more regular shooting can be obtained at long ranges with the latter, and state that, although they have fired many hundreds of these cartridges, and have supplied thousands more, they have never seen or heard of one of these guns giving out at the choke with their use.

## Mr. Charles Lancaster's Patent Hammerless Lock for Wildfowling and Punt Guns.

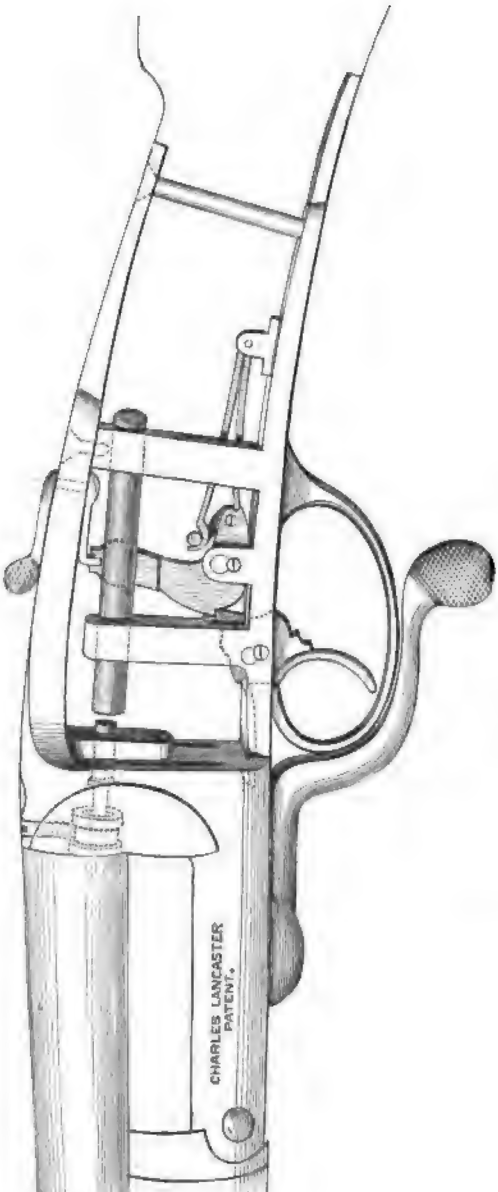
The following description of this lock is given me by the inventor:

"This lock is a modification of the lock used in constructing the Charles Lancaster 4-barrelled guns and rifles, and on inspection will be found to be very simple, strong, and effective, and having less parts than an ordinary lock, all of which parts are of exceptional strength. To understand this lock, first the attention is drawn to the shape of the hammer piston rod, which is a stout piece of round steel, in which is cut a slot, so that the top of the tumbler may pass into it. This rod is firmly socketed horizontally, that is to say, parallel with the axis of the barrel, and opposite the centre, and is capable of giving a direct blow to the striker. In this hammer-rod there is a slot which receives the blow of the tumbler fitted into it; this is furnished with a swivel and a flat mainspring hung on the rebounding principle.

"To cock the hammer-rod the back of the top of tumbler rests against the slot in the hammer-rod, by which it is enabled to bring back the hammer-rod to full-cock from the half-cock, where it was left by the rebound.

"The trigger is of the usual pattern; to this is hinged a lifting scear, which fits into a deep bent, or notch, cut in the tumbler in such a form that as the trigger is pulled it lifts the tumbler backwards over its centre or axle, and at the same time compresses the mainspring. The shape of the breast of the tumbler causes the scear then to leave the bent, when the tumbler drives the hammer-rod forward to explode the cap.

"Immediately after this, a long straight spring under the front of the trigger carries the scear into the bent of the tumbler ready for the next shot, in which it is assisted by a light spring between the scear and trigger.




**Mr. Charles Lancaster's Patent Hammerless Lock for 4-Bore Wildfowling, and Punt Guns.**

"In regard to safety. As the cock is rebounding it cannot be jarred out of its bent in loading, and the danger of an accidental discharge is confined to the pull of the trigger. As this pull is longer than in an ordinary gun, being what is technically called a 'draw,' this danger is reduced to a minimum; but it exists nevertheless, and is provided for by a safety bolt, which is fixed in the tang of the break-off, and when used pushes a bolt into the tumbler, by which this part is most securely locked.

"It may therefore be said that from all danger of a discharge in loading this gun is free; and that the safety bolt, if used effectually, prevents the accidental discharge of the gun by a pull of the trigger.

"In opening the gun the lock is left quite undisturbed and at half-cock (and can be bolted if required), as neither the fall of the barrel nor the lever acts upon it, as in most hammerless guns.

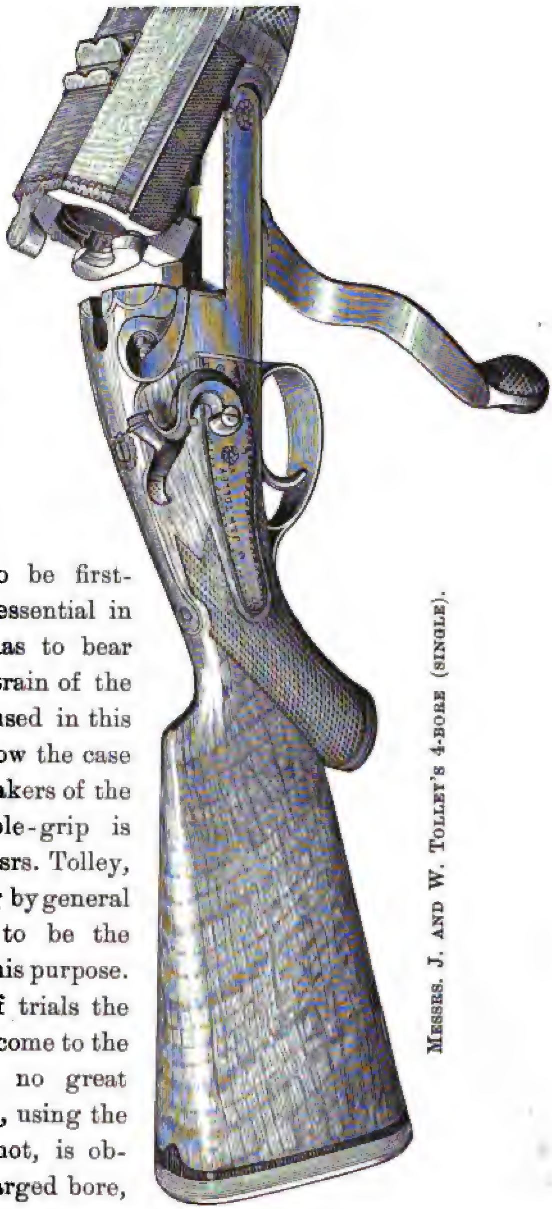
"The exclusion of water and gas from the lock is well provided for, as the action being double grip, with an extension doll's head, there is no possibility of either entering the lock-work, as the work is behind the front upright of the trigger plate in which the hammer-rod is partly carried. The stock is unusually strong, being cut away very little for the single lock, and it is dropped into two side slots in the back of the break-off, by which any side twist is prevented."

## SECTION III.

### Hammered 4-bore Shoulder Guns.

These guns have long been made by most gunmakers, I insert those which are remarkable for either quality or price, or both.

MESSRS. TOLLEY'S WILDFOWL 4-BORE SHOULDER GUN.



MESSRS. J. AND W. TOLLEY'S 4-BORE (SINGLE).

The above well-known firm, who have for some years paid great attention to wildfowling guns, make them of two qualities, viz., Standard and First, the price varying accordingly. In both they warrant the workmanship to be first-class, which is essential in a gun which has to bear the enormous strain of the heavy charges used in this sport. As is now the case with most gunmakers of the day, the double-grip is adopted by Messrs. Tolley, that action being by general consent found to be the best suited for this purpose. After a series of trials the above firm have come to the conclusion that no great increase of force, using the same size of shot, is obtained by an enlarged bore,

the chief gain being in pattern, owing to the larger charge of shot. But this extra charge permits the larger sizes of shot to be employed, as is well known to wildfowlers, and with this extra size is obtained the extra force, which flattens a B B shot to the size and thickness of a sixpence at 100 yards or more. With this knowledge, Messrs. Tolley recommend a double 8-bore, rather than a single 4-bore, for most kinds of wildfowling, the difference of weight between 12lb. and 15lb. being, together with the diminished recoil, sufficient to counterbalance the loss of an ounce of shot in each charge. Nevertheless they say:

"Those, however, who can handle a 4-bore single gun of 15lb. weight may comfort themselves that they have as powerful a gun as can be used from the shoulder, except in isolated cases, as we sometimes build a double 4-bore for a man of unusual physique, weighing 18lb."

With regard to their two qualities they write:

"Our Standard quality is as plain in finish and material as is compatible with effectiveness; the barrels are of English Damascus, or laminated steel, and the body and action plain, but really good. We thus get in all these guns the essentials of reliable guns. As we have already said, they are fully choked, and stand to their work without flinching at the choke; anything but good well-hammered engine-made barrels would be useless, as the foreign barrels, though handsome and free from greys, are soft, and soon lose the form given to them in boring. The first quality is intended for those who are able to afford a gun of best quality throughout. This gun is not ornamented any more than the 'Standard,' as it is felt that engraving and mere ornament are out of place in such a gun.

"We always recommend our 'Standard' quality guns to those persons who, getting but occasional opportunities of using a gun at fowl, look out for a second-hand gun on

account of its price, forgetting that such a gun may not have the advantage of choke-boring; and they are exceptionally lucky if they get a good secondhand gun made on modern principles cheaper than we can supply them with a new well-shot gun, the responsibility for the turning out of which they can fix on the maker."

MESSRS. J. AND W. TOLLEY'S 8-BORE (DOUBLE).

The 4-bore gun has folding sights arranged for 100 yards and 150 yards, which Messrs. J. and W. Tolley think to be indispensable for long ranges. Without them it is impossible as they think to make the gun of any use at more than one range, the drop of the shot beyond 80 yards setting all calculation at defiance. The following particulars will be of interest to many of my readers:

## PRICES AND PARTICULARS OF WILDFOWL GUNS.

### STANDARD QUALITY.

| GUN. | BARREL. | WEIGHT. | CHARGE. | | HAMMER GUN. | | | HAMMER-LESS GUN. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | POWDER | SHOT | | | | | | |
| 12-bore single (cripple | in. | lbs. | drams. | oz. | £ | s. | d. | £ | s. | d. |
| stopper) .............. | 26 | 6 | 3 | 1⅛ | 6 | 0 | 0 | ... | | |
| 10-bore single ........... | 32 | 8½ | 4½ | 1½ | 10 | 10 | 0 | 15 | 10 | 0 |
| 8-bore „ ........... | 34 | 11 | 6 | 2 | 13 | 0 | 0 | 18 | 10 | 0 |
| 4-bore „ ........... | 38 | 15 | 8½ | 3 | 18 | 0 | 0 | 25 | 0 | 0 |
| 10-bore double........... | 32 | 9¾ | 4½ | 1½ | 14 | 14 | 0 | 20 | 0 | 0 |
| 8-bore „ ........... | 34 | 12 | 6 | 2 | 16 | 0 | 0 | 22 | 0 | 0 |
| 4-bore „ ........... | 36 | 18 | 8½ | 3 | 24 | 0 | 0 | 33 | 0 | 0 |

### FIRST QUALITY.

| GUN. | BARREL. | WEIGHT. | CHARGE. | | HAMMER GUN. | | | HAMMER-LESS GUN. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | POWDER | SHOT | | | | | | |
| 12-bore single (cripple | in. | lbs. | drams. | oz. | £ | s. | d. | £ | s. | d. |
| stopper) .............. | 26 | 6 | 3 | 1⅛ | 9 | 0 | 0 | 13 | 0 | 0 |
| 10-bore single .......... | 32 | 8½ | 4½ | 1½ | 15 | 15 | 0 | 23 | 0 | 0 |
| 8-bore „ ........... | 34 | 10½ | 6 | 2 | 20 | 0 | 0 | 28 | 0 | 0 |
| 4-bore „ ........... | 38 | 15 | 8½ | 3 | 25 | 0 | 0 | 35 | 0 | 0 |
| 10-bore double........... | 32 | 9¾ | 4½ | 1½ | 22 | 0 | 0 | 30 | 0 | 0 |
| 8-bore „ ........... | 34 | 12 | 6 | 2 | 25 | 0 | 0 | 35 | 0 | 0 |
| 4-bore „ ........... | 36 | 18 | 8½ | 3 | 36 | 0 | 0 | 50 | 0 | 0 |

**A slight variation can be made, either way, in the weights of the above.**

**EXTRAS.—Silver's patent heel pad, 21*s*. Sighting 4-bore at two distances, 30*s*. Half, or full pistol hand stock, 20*s*.**

Messrs. Tolley have also furnished me with the results of their experiments with these guns, which I append:

"With regard to the performance of these guns, we have given what we consider the extreme range of each of the bores; thus we put the 10-bore at 100 yards, the 8-bore at 120 yards, and the 4-bore at 150 yards. Of course at these ranges no one would think of firing at less than a flock, and we may say here that we have proved the force at the longer

range by flattening to the size of a wafer a moulded S.S.G. shot at 150 yards on an iron plate.

"We find, however, that in using this large shot, and throwing it to so great a distance, we have to take trajectory into account, for in trying a charge of S.S.G. shot over a lake at a target 150 yards distant, we found the charge strike the water some yards on the rear side of the target. This has induced the use of a back-sight, as in a rifle, to lift the charge up (see page 345).

"The spread of the charge is about 10 feet at 120 yards, and we got with an 8-bore, using 7½drs. and 2¼oz. B.B., a pattern of 130 pellets on the whole space of 10ft. 6in.

"At 100 yards the spread is still about 10 feet, with an improvement in the pattern.

"At 80 yards, spread 10 feet, we got 369 pellets of No. 4 shot on the whole space, showing its effect on a flock.

"The spread of the charge from the 4-bore is greater than that from the 8-bore, measuring 12 feet as against 10 feet.

"At 150 yards, with S.S.G. shot, using 9drs. and 3½oz., 11 pellets were put in the 12 feet square. At 120 yards, with the same gun and charge, except that B.B. shot was used, we got 86 pellets on the whole square; while at 100 yards, the spread being still 12 feet, we got 184 pellets of No. 1, using the same charge of powder and shot; while at 80 yards, with No. 4 shot, we get on a square of 12 feet 386 pellets of No. 4 shot. We hope some day to get brass cases for these large bores, when better results than the foregoing may be realised.

### Messrs. Bland's 4-Bore (Wildfowling) Gun.

In wildfowling guns price is a great object, as from the continual contact with salt water they very soon become rusted and spoiled. An engraving of Messrs. Bland's cheap


MESSRS. BLAND AND SON'S 4-BORE WILDFOWLING GUN.

4-bore (21 guineas) is therefore inserted here, and, as it has been highly approved of by "Wildfowler," I need not append any comments of my own. At the above-mentioned low price its rebounding lock and furniture are nickel-plated, and it is fitted with Silver's rubber recoil pad. The action is the ordinary double grip, and the barrels are choked or cylinder at the discretion of the purchaser, but usually choked.

## SECTION IV.

### 8-bore Wildfowling Guns.

These guns, usually double-barrelled, are made by all gunmakers with all kinds of actions, but, as they are generally charged with at least 4drs. of powder and 1¾oz. shot, the action must of necessity be a strong one. Those most in demand are Greener's treble bolt hammered or hammerless (page 162), or Scott's hammerless (page 194), or the ordinary double grip (*passim*), or, the 8-bores made by Messrs. Holland and Holland which are upon the same principle as their 4-bores. Length of barrel, 36in. to 40in.; weight, 12lb. to 13lb.; charge, 6½ to 7drs. of powder, and 2oz. to 2½oz. of shot. They are made with the same shape of stock, and are fitted with the recoil heelplate and pistol grip.

## SECTION V.

### Ammunition for Shoulder Duck Guns.

Both with 4 and 8-bores the ordinary paper cases are generally used, but sometimes the brass cases are preferred. Black powder is almost always adopted, but Schultze's powder is sometimes used. Sportsmen are, however, somewhat nervous in using such large charges of this powder, and, with our present knowledge, I certainly should not advise it,

especially as the absence of smoke is not important when a single barrel only is used. The charges of powder and shot are given at page 438.

## SECTION VI.

### Cripple Stoppers.

Inasmuch as the practice (before mentioned) exists with wildfowlers of shooting "into the brown," many birds are crippled in the wing without being killed, and having their legs entire, they can swim and dive so as to escape from the retriever. To bring these to bag, either from motives of humanity or gain, the wildfowler is provided with a 12-bore gun, nickel plated to resist the salt. These, of course, are soon spoiled, and cheapness is of considerable importance. The lowest price is that of Messrs. Bland, viz., 8 guineas.

## SECTION VII.

### Recoil Pads.

The object of these pads is to protect the shoulder from the heavy recoil given by 8-bores and 4-bores, and notably the latter.

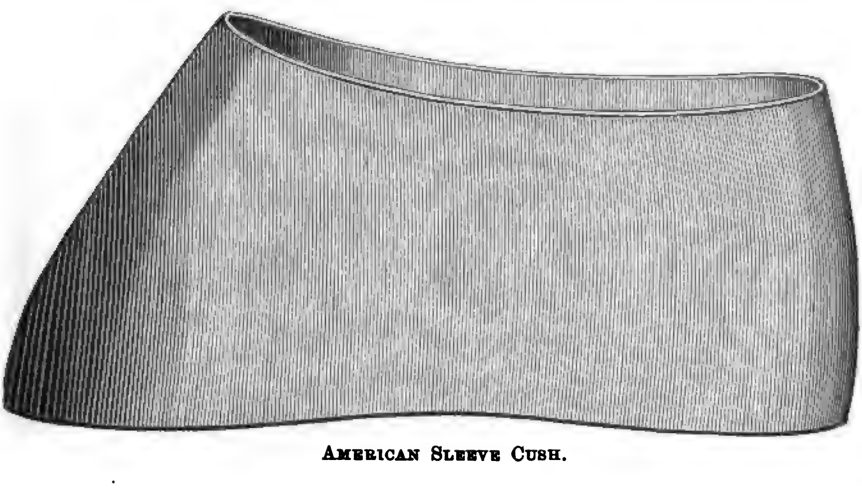
### Silver's Recoil Pad.

Messrs. Silver, of Cornhill, have patented a combination of hard vulcanite and soft vulcanised indiarubber, which are easily made to unite in the manufacture. The thin layer of vulcanite being hard enough to take the head of a screw is thereby fastened to the stock by drilling a hole in the soft and thick layer of elastic rubber, from $\frac{3}{4}$in. to 1in. thick, and capable of absorbing a large amount of recoil. After the screws are inserted the holes are filled up with rubber similar in colour to that which has been taken out, leaving a neat appearance. But for snap shooting, such as that at game, the rubber hangs too much to the shoulder, and is not

approved of. The appearance of this pad is given in the stock of Messrs. Tolley's 4-bore, at page 435. The price is rather high, being 1*l.* 1*s.* to the trade.

### American Sleeve Cush.

Under the above title a cheap substitute, though rather a poor one, for the Silver pad is imported into this country from America. It is a loose cap of cloth, covered with waterproofing to protect it from the wet, and fitted to the butt of the stock, so as to be removable at will. It is lined with rubber about ⅜in. thick, and absorbs the recoil fairly well, but unless the "cast-off" of the gun is unusually great it interferes with the aim by holding the gun away from the right eye. For slow wildfowl shooting—that is to say, on the water—it answers well enough, but not for flight shooting. The retail price is 5*s.*



American Sleeve Cush.

# GLOSSARY OF TERMS.

**Action.**—The piece of iron by which the breech is closed.

**Anvil.**—A small piece of brass inserted in the cap of cartridge cases.

**Bend.**—The inclination downwards of the stock.

**Bent.**—*See* Scear.

**Break-off.**—Part of action immediately behind breech.

**Breech.**—The back end of the barrel.

**Breech-rail.**—The screw which passes through the tang of break-off, the stock, and the trigger block.

**Bridle.**—Polished piece of steel, which caps the tumbler, is put on with screws, and afterwards receives the scear-screw.

**Cap.**—The little cup of copper containing the detonating compound.

**Casting off.**—Inclining outwards of the butt, so as to bring the line of aim inwards, and more ready to meet the eye.

**Chain, or Swivel.**—A little catch, suspended from the neck of the tumbler, to receive the end of the mainspring.

**Chamber.**—The part of the barrel that receives the cartridge.

**Cramp.**—A small instrument for confining the spring on taking the locks to pieces.

**Facing up.**—Refitting a shaky action.

**Fore-end.**—The piece of iron clothed with wood, which completes the action, and is fastened to the barrels.

**Guard.**—Bow which defends the triggers.

**Hammer or Cock.**—The piece which strikes the cap.

**Heel-plate.**—Plate with which the butt is tipped.

**Lock-plate.**—Plate on which the lock is formed.

**Loops.**—Eyes to barrel, which receive the bolts that fasten it into stock; or in breechloaders, which drop into the fore-end.

**Main-spring.**—That by which the tumbler is worked.

**Safety Bolt.**—A bolt by which accidents are prevented, at those times when the trigger is not voluntarily pulled.

**Scear.**—Part which catches the tumbler, for half or whole cock, and which, being pushed up by the trigger, lets off the gun.

**Scear-spring.**—The spring, which presses the scear against, and holds it in the notches or bents of the tumbler, for either half or whole cock.

**Scroll-guard.**—A concave bow, continued backwards from the guard, to steady the hand.

**Side-nail, or Pin.**—Screw which fastens on the lock.

**Sight.**—Little bit of gold or silver, to bring up to the object, when taking a deliberate aim.

**Striker.**—The part which immediately strikes the cap.

**Top-piece, or Top-Rib.**—Long piece of iron forming a groove, along which is directed the line of aim.

**Trigger-plate.**—Plate in which the triggers work.

**Trigger-springs.**—Small springs to keep triggers constantly pressed close to scear.

**Tumbler.**—The movable centre-piece of a lock, which carries the hammer, or which in hammerless guns takes the place of the hammer.

# APPENDIX.

## A.—Siemens's Steel for Gun Barrels.

Since the section treating at page 83 *et seq.* of barrels and barrel iron went to press, in which I stated that no steel other than Whitworth's was now used for gun barrels, I have learnt from Messrs. P. Webley and Son, of Birmingham, that for some time past they have used Siemen's steel in large quantities for this purpose—with most satisfactory results. At my request they have sent me the following report:

We have for the last three years used a brand of steel made by Messrs. Siemens's process for our rifle barrels of every kind, including sporting rifles, Sniders, Martini-Henry, "M. B. L.," and Match, with the best results. The entire freedom from specks, flaws, and hard and soft places in this steel, is most remarkable; at the same time it is sufficiently dense and close in structure to admit of the highly finished and perfectly smooth surface essential to the interior of a fine rifle barrel. Our experience in making some 700 rifle barrels led us to adopt the same steel for shot barrels, and with the same success. We have never had a single barrel burst, and only one tube bulge at either first or second proof—a result never before occurring in our experience, either with Damascus or other kinds of steel barrels. We have now instituted comparative trials of the relative tenacity of this steel and Damascus iron, &c., and we are quite satisfied with the manner these proof tests have been endured. It must also be noted that these shot barrels are invariably fully bored up and choked (except final leading out) in the tube state before putting together and brazing the breech ends. In all our best barrels this is done before provisional or first proof, thus giving the barrels the severest test

they can have. We, of course, afterwards open the choke to the modified or slight form, as may be required; the more opened the less strain thrown upon the barrel. Having obtained at last a steel free from the grave faults hitherto existing in this metal, arising from unequal density and an ill-balanced crystalline structure causing that brittleness of fracture so dangerous in a gun barrel, we claim that, though this steel be only equal to best Damascus iron in tenacity, still its freedom from greys and soft places (faults impossible to avoid in figured iron), and the fact of the manufacture and cost of tube, when ready for barrel filer, being little more than that of the plainer kinds of Damascus, no more suitable material exists for gun barrels. We have written the Messrs, Siemens for particulars of tensile strain, &c., endured by the special brand of steel we use, and now forward the same.

THOS. W. WEBLEY.

Messrs. P. WEBLEY and SON,
82 to 84, Weaman-street,
Birmingham.

DEAR SIRS,

Replying to your favour of yesterday, we have not allotted a special brand to our gun-barrel steel as yet, having made it only for a few friends in the trade in Birmingham. I should call it S S S gun steel, as it is made from specially selected brands of English and foreign irons in order to give it that toughness, and render it free from specks or seams, whilst being very soft and easy to work. As a rule, the tensile strength is about 25 to 27 tons per square inch, but can increase it if required, with an elongation of 30 per cent. or more in eight inches. A very similar quality of steel is used in making soft card wire, which is frequently drawn down to 36 W G, and whilst in that shape it has to stand the test of being bent backwards and forwards without breaking in the first three tries, thus showing extreme ductility.

Should you desire any further details, I shall be happy to supply all I can to further your object.

Yours truly,
D. CAMPBELL.

Annexed is the report of the test to which Messrs. P. Webley and Son submitted two barrels of equal weight, calculated for a very light 12-bore gun (viz., pair of barrels,

3lb.) The steel Damascus was of Marshall's best iron, and a picked barrel—the steel of the average metal, the eye not being able to make a selection, there being of course no figure—the result was that the bursting charge was as nearly as possible equal. The rent in the Damascus, as shown to me, gives the appearance of unusual tenacity, and certainly would lead one to suppose the trial to have been a perfectly fair one. I should hardly imagine this steel to be quite equal to the Whitworth, but the difference between them cannot be great.

Report of increasing proof tests of two B. L. tubes made from "Marshall's hard Damascus iron," three stripe, and one made from "Siemen's steel," both tubes being full 13-bore, and weighing 1lb. 8oz. each, each about 4oz. lighter than is required to make a 7lb. gun with ordinary action.

| Provisional Proof Charge. | Charge Used. | Damascus. | Steel. |
|---|---|---|---|
| For 13-bore | 12 drs. | Stood proof perfectly. | Ditto. |
| 12 " | 12¾ " | Ditto. | Ditto. |
| 10 " | 13½ " | Ditto. | Ditto. |
| 9 " | 14½ " | Ditto. | Ditto. |
| 8 " | 17½ " | Shaken slightly. | Stood perfectly. |
| 7 " | 19¼ " | Bulged at quarter round. | Bulged at quarter round a little more than Damascus. |
| —— | 21¼ " | Bulged more. | Burst. |
| 6 " | 22½ " | Burst. | —— |

Proved in the presence of Mr. Joseph March (Proof Master) and of myself, at the Birmingham Proof House, October 11, 1882.

Thos. W. Webley.

The tubes were not washed or wiped out during the whole trial, which added much to its severity.

## B.—Choking by Compression.

In connection with the above subject I may mention that I have now permission to make public a fact which has been for about two years known to me, though only under a pledge of secrecy. This fact is, that choking has been carried out in

the manufactory of Messrs. P. Webley and Son for three years by compressing the muzzle after it is bored out as a cylinder, and not by the usual means, as described at page 123. They ascertained by experiment that in this way the metal is even more unyielding to expansion than after boring, while the steel core on which the compression is applied is much more truthful in its results than any cutter can possibly be. They are so satisfied of the advantages of the plan in this last respect, from the trials at the plate, and are so convinced of the absence of any subsequent disadvantage in "wear and tear," which an experience of three years has afforded them, that they have now given me permission to publish this account.

Everyone who has at all studied the subject is aware that compression by swedging was originally practised in America for the purpose of choking cylinder barrels, and abandoned from the expansion by wear which was afterwards found to take place; but those barrels were, of course, too thin in the muzzle, and no doubt expanded from that cause, as, indeed, all the early-choked barrels always did for want of metal. This defect is, however, guarded against by Messrs. Webley by forging the barrels thick enough at the muzzle, and reducing the substance by pressure at the choke from without instead of doing this by cutting from within.

# INDEX.

# INDEX TO ADVERTISEMENTS.

## GUNPOWDER MANUFACTURERS—



## GUNS, MANUFACTURERS OF—

## CARTRIDGE MANUFACTURERS—



## GUNS, DEALERS IN—



## MISCELLANEOUS—

# GUNPOWDER.

TRADE  MARK.

EACH FLASK THUS LABELLED.

## MESSRS. JOHN HALL & SON

**BEG respectfully to direct the attention of Sportsmen to the varied and well-known Brands of their manufacture, which, with the traditions and experience of very many years, are yet constantly adapted to the enlarged development of practical science in Guns.**

**Their familiar SPECIALITIES—the "RIFLE," "GLASS," and "TREBLE STRONG" POWDERS, in all Sizes of Grains (from Nos. 1—8)—will be found worthy of their fame: while the Brand recently introduced with so much success—"FIELD B." —specially prepared for Choke-bore Guns, and giving admirable results in competitive Matches, brings up Black Gunpowder to its highest present excellence, and insures those trustworthy and calculable results which *can be obtained by no other form of explosive.***

**Messrs. HALL'S GUNPOWDER may be obtained of all Gunmakers and Dealers; and Sportsmen who do not fill their own Cartridges will do well to insist that the Powder of their choice is used in the cartridges they buy.**

**N.B.—Sportsmen in India and the Colonies are urgently solicited to see that they are supplied with *the highest class of Sporting Powder*, and not to be satisfied with the lower qualities largely in demand for ordinary commercial purposes, which, while of excellent proportionate quality, differ widely from the ammunition on the use of which a man may safely stake his reputation, and, as has often happened, his life.**

---

**All Messrs. HALL'S Best Sporting Powder sent to India now bears this additional Trade Mark.**

TRADE  MARK.


## MILLS :—FAVERSHAM, KENT; LOCHFYNE, ARGYLLSHIRE.

**Established by Queen Elizabeth A.D. 1565.**

---

## Office: 79, Cannon Street, London, E.C.

# HOLLAND & HOLLAND'S

## NEW ·295-GAUGE ROOK RIFLE

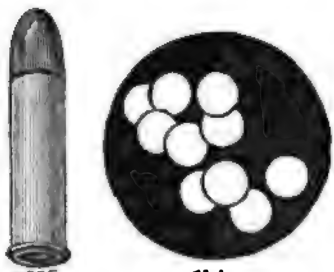
## "THE MINIATURE,"

**SEMI-SMOOTH BORE NON-FOULING RIFLING**

(REGISTERED).

---

**AUTHENTICATED DIAGRAM made before the Editor of the "Illustrated Sporting and Dramatic News," April 5, 1882.**



·295 1½-in.

**10 Shots, range 50 yards; after firing 500 Shots without cleaning out. All in 1½-inch Bullseye. Out of 220 Shots fired at Card Targets, 212 were in a 2-inch Bullseye.**

**Fired from one of our New Top Snap ·295-gauge Semi-Smooth Bore Rifles. See "Illustrated Sporting and Dramatic News," April 8, 1882**

**See also letter to the Editor of "The Field," May 20, '82:**

"SIR,—I have lately purchased a ·295 Rook Rifle from Holland and Holland, and my experience may be of some use to Y. N. S. I have only a chance of trying the Rifle up to 60 yards range (under cover). I find at that range the trajectory is very flat, and the accuracy remarkable. With the Rifle fired from a rest **25 Shots were fired at 50 yards, and all would have struck half-a-crown**; this after 400 shots had been fired without cleaning out. I have this day compared the ·295 with a ·360 Rifle which has been in my possession some years. The advantages are all in favour of the smaller bore, both for accuracy, flatness of trajectory, and penetration. I have shot rooks with the ·295, and the bullet has left a clean hole, apparently as if burned. . . . . .

" (Signed) W. HOWARTH.

"Manchester, May 17, 1882."

---

Each Rifle guaranteed in every way, and may be shot at our Private Range at Kensal Green before Purchase.

**Prices: Best Top or Side Snap Ejectors, with Rebound Lock-snap Forepart Lined Sights, &c., 10 Guineas; Second quality, 7 Guineas.**

**CATALOGUES UPON APPLICATION.**

---

# HOLLAND AND HOLLAND,

## 98, NEW BOND STREET, LONDON, W.

# HOLLANDS'

## '360-BORE

# ROOK AND RABBIT RIFLES.

## The following Diagrams were made by Mr. Horatio Ross, with one of Hollands' '360-Bore Rabbit Rifles :—

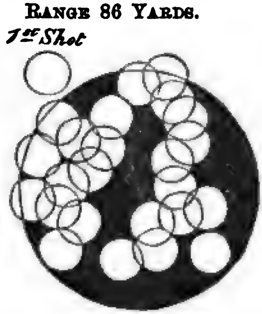
**Extract from letter received with the Diagrams:**

"Rossie Lodge, Inverness,
"June 3, 1882.

"Gentlemen,—I have much pleasure in sending you some Diagrams, made by me, with your little Rabbit Rifle a few days since. I have never seen better shooting made (with a Sporting Rifle) in this country. . . . . You are welcome to make any use of the Diagrams. I shot sitting, using a table rest for my elbows.

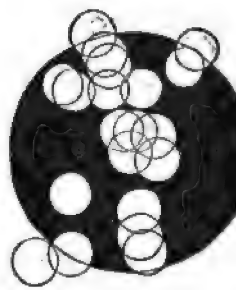
"I am, Gentlemen, yours truly,
"(Signed) HORATIO ROSS."

Range 86 Yards.




½-Scale.

Range 100 Yards.



½-Scale.

**See also letter, "Field," August 12, 1882:**

"I have killed, with one of Hollands' ·360 Six Guinea Rifles, rabbits, hares, rook, seals, and about 35 red deer, at distances up to 150 yards. I have killed all the deer dead with the exception of four, they went only some 300 yards. . . . "ALINE."

The Rifles are more powerful, and are sighted to a longer range than the ·295 (see previous page), and are specially adapted for

## SEAL SHOOTING AND RABBIT SHOOTING.
## IN INDIA, FOR BUCK SHOOTING.
## IN AUSTRALIA, FOR KANGAROO, &c., SHOOTING.

They are perfectly accurate up to 150 yards range. Shooting may be tested before purchase at our Private Range. Rifles exchanged free of charge if not approved of.

## PRICES £5 TO 10 GUINEAS.

**Orders from strangers should be accompanied by Remittance or London reference.**

# HOLLAND AND HOLLAND,

## GUN AND RIFLE MANUFACTURERS,

## 98, NEW BOND STREET, LONDON, W.

# THOMAS BLAND & SONS,

## GUN AND RIFLE MANUFACTURERS,

## LONDON, LIVERPOOL, AND BIRMINGHAM.

## SPECIALITIES IN GUNS.


**CAUTION.**—In consequence of the unfair competition to which they have been subjected, and the way in which other makers have sold inferior arms under the name of "The Keeper's Gun," originally introduced into the trade by their Firm, Messrs. BLAND have been obliged, in self-protection, to adopt a trade mark for their "Keeper's" Guns, and for the future no "Keeper's" Gun will be issued by them without having the Trade Mark on the heel-plate.

The wording will vary so as to indicate the character of the Gun, whether a "Keeper's," a "Keeper's" New Model, or a "Keeper's" Hammerless, but in each case the Trade Mark will be the figure of a Keeper with his Gun under his arm, and accompanied by his Dog; in a circle, with the words, "THE KEEPER'S GUN."

An engraving of a specimen heel-plate so marked is appended.

# "THE KEEPER'S GUN,"

## A CENTRAL-FIRE BREECHLOADER

**In 10, 12, 14, 16, and 20 bores.**

**PRICE 6 GUINEAS (WITH CHOKE-BORE BARRELS, 21s. EXTRA.)**

**STRONGLY RECOMMENDED.**

From the Head Keeper to the Earl of Warwick, Grayfield Wood, High Littleton, near Bristol, June 24, 1880.—"'The Keeper's Gun,' No. 4535, stands its work wonderfully well, and is really the very best killing gun I ever had. I dare say I have fired 8000 cartridges from it during the time I have had it. I killed a carrion crow the other night with the left barrel (full choke) at 104 measured yards, measured by a witness present."

**Addresses:—106, STRAND, LONDON, W.C.; 62, SOUTH CASTLE STREET, LIVERPOOL; and 41, 42, and 43, WHITTALL STREET, BIRMINGHAM.**

# ADAMS AND CO.,

## GUN, RIFLE, AND REVOLVER MANUFACTURERS,

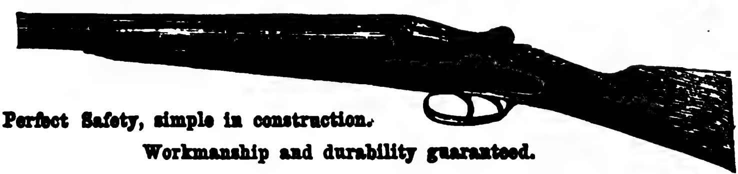
32, Finsbury Pavement, London, E.C.

(MOORGATE STREET STATION, CITY.)

## HAMMERLESS GUNS,

UNDER AND TOP LEVER SNAP ACTION.

Prices from 10 Guineas.



**Perfect Safety, simple in construction.**

**Workmanship and durability guaranteed.**

## Central-fire Hammer Guns,

NEW IMPROVEMENTS. REDUCED PRICES.

## ADAMS AND CO.'S SPECIAL GUN,

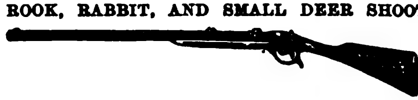
**Price £7.**

**CENTRAL-FIRE DOUBLE-BARREL GUN (12, 16, or 20-bore), Double Grip Action, Rebound Locks, with Low Hammers, Patent Snap Fore-end, Choke or Cylinder bored Hard Damascus Barrels.**

**Every Gun Guaranteed, and exchanged if not approved of.**

## ADAMS AND CO.'S MARTINI-ZELLER PATENT RIFLES,

FOR ROOK, RABBIT, AND SMALL DEER SHOOTING.



**Accurately Shot and Sighted for 50 and 100 Yards. Self-cocking, ejects the fired cartridge clear of the rifle, accuracy of shooting unsurpassed.**

**380 Bore ... ... ... ... ... ... ... ... ... ... Price £3**

**360 „ (for Eley's ·360 No. 5 Express Cartridge), extra quality ... „ £4**

**See Illustration and testimonials in Price List.**

## LARGE BORE AND EXPRESS RIFLES. REVOLVERS.

**Illustrated Price List Post Free.**

# CHARLES LANCASTER,

## INVENTOR OF THE SMOOTH OVAL-BORE FOR EXPRESS

('360, '400, '450, '500, and '577), Prices from £36 to £56. 10s. Nett.

AND

## ROOK AND RABBIT

('295, '320, '360, and '380), Prices from £5 to £10 Nett.

AND

## MINIATURE MATCH RIFLES.

**GOLD MEDAL AWARDED AT CLEVES, 1881.**

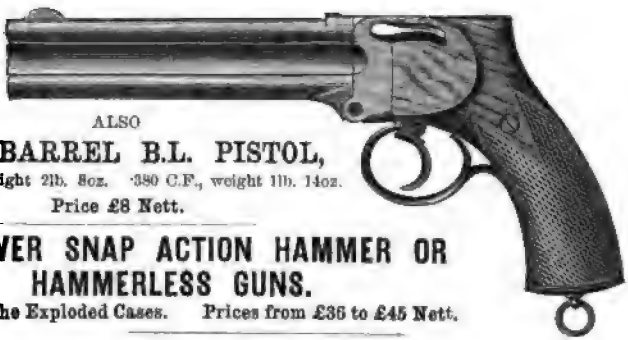
See THE FIELD, March 26, April 2, June 11, 18, and 25, July 9, 23, 30, Aug. 6, 20, 1881; and LAND AND WATER, Nov. 29 and Dec. 24. THE FIELD, Feb. 18, 25, May 13, 20, and 27, 1882.

INVENTOR AND PATENTEE OF THE

## FOUR-BARREL B.L. HAMMERLESS GUN,

WEIGHT 7lb. 4oz and

## EXPRESS RIFLE, weight 10lb.



ALSO

## FOUR-BARREL B.L. PISTOL,

·455 C.F., weight 2lb. 8oz. ·380 C.F., weight 1lb. 14oz.

Price £8 Nett.

## TOP LEVER SNAP ACTION HAMMER OR HAMMERLESS GUNS.

Ejecting the Exploded Cases. Prices from £36 to £45 Nett.

**The "Colonial" quality 12-Bore Top Snap Gun,** plainly finished, but good sound work, price £20 nett; Case and Fittings £3 nett.

# CARTRIDGES

(FOR CASH WITH ORDER ONLY)

## 10s. PER 100.

ELEY'S Best GREEN or KYNOCH'S BRASS CASES Loaded with 3 drachms of Curtis and Harvey's best Powder, 4 best Wads, and 1¼oz. Hard Shot, thin Cases included. Stout Cases, for rail, 6d. first 200, adding 2d. each additional 100.

Schultze or the new "E.C." Powder, 1s. 3d. per 100 Extra. Prices of 16 and 20 bore loads at lesser rates.

PRICE LISTS OF GUNS, RIFLES, PISTOLS, ETC., ON APPLICATION.

## 151, NEW BOND STREET, LONDON, W.

**ESTABLISHED 1826.**

# JAMES WOODWARD & SONS,

PATENTEES AND MANUFACTURERS OF

## "THE AUTOMATIC"

## Patent Hammerless Safety Gun,

**FOR WHICH A PRIZE MEDAL WAS AWARDED AT THE PARIS EXHIBITION.**

HAVING had six years' experience with perfect success, we have the greatest confidence in recommending our Hammerless Safety Gun to our clients and their friends.

One of the numerous advantages is that the same locks and action are used as in ordinary bar guns, with the exception that the hammers are inside instead of out; in other respects the outlines are precisely the same. The hand lever centred on the trigger plate has a lifting bar hinged to it, which bears on the arms projecting from the tumblers. It raises the locks, and at the same time moves a safety bolt over the ends of the triggers, and one in front of each hammer, so that should the lock be jarred off by a fall, the safety bolt in front of the hammer would catch it in the throat immediately at starting, rendering it impossible for any accidental explosion to happen. The construction of the lifting bar, hinged on the hand lever, is so arranged that very little force is required to raise the locks, consequently the same weight main-spring can be used as in a gun with outside hammers, avoiding any chance of miss-fires so often complained of in hammerless guns.

Our great safety point is that on opening the gun *all parts are bolted*, and, however clumsy the attendant loader may be, the shooter is perfectly safe compared with outside hammer guns that are always liable to be loaded at full cock.

---

FOR PRICES AND FULL PARTICULARS APPLY TO:

## JAMES WOODWARD & SONS,

**EXPRESS GUN AND RIFLE MANUFACTURERS,**

**64, ST. JAMES'S STREET.**

**Manufactory—1, BLUE BALL YARD, LONDON.**

# IMPROVED BREECHLOADERS.

**LARGEST STOCK IN LONDON, BEST WORKMANSHIP, WITH LATEST IMPROVEMENTS.**

**Top and side lever rebounding locks, hammers below line of sight, compressed steel barrels, choke bore, &c. Light 12-bores for Kynoch's brass cases mark 14, twelve wad.**

**Likewise in pairs and sets of three in same case, finished ready as in stock or made to order.**

## SPECIAL PIGEON GUNS,

**Of great power, Hurlingham weight, &c. Whitworth's Steel Tubes. Marvellous pattern. Trial at our private Shooting Grounds.**

# HAMMERLESS GUNS.

THE BEST AND LATEST SYSTEMS.

**Top lever side locks, with safety block interposing, dislodged by the triggers in firing. Perfect safety.**

## SECOND - HAND CENTRAL - FIRES,

**Best London makers, at low prices. Several pairs of fine Guns.**

**EXCELLENT PLAIN CENTRAL-FIRES & HAMMERLESS GUNS,**
TEN TO FIFTEEN GUINEAS.

**Low price Keepers' Guns, 5 to 10 guineas.**
**Wildfowl Guns, single and double, 4, 6, and 8-bore, full choke. Splendid lot of Guns ready to select from.**

## SEASON 1882.

**Prizes won by our Special Pigeon Guns at Hurlingham, the Gun Club, the International Gun and Polo Club, &c.**

**Extract from "Holt's Shooting Calendar," Sept., 1882: "Messrs E. M. Reilly and Co. scored ninety wins; amount of money won, £6148. Seventeen cups, value of £529, including the following: Paris Cup, value £75, and £200 in money; Belgian Cup, value £75, and £200 in money; Club Fund Cup, and the Thursday Cup, and Gold and Silver Medal."**

# E. M. REILLY AND CO.,

**277, OXFORD STREET, W.; 16, NEW OXFORD STREET;**
**And RUE SCRIBE, PARIS.**

# G. H. DAW and CO.,

## 67, ST. JAMES'S STREET, S.W.

AND

## 57, THREADNEEDLE STREET, E.C., LONDON.

PATENTEES AND MANUFACTURERS OF

# HAMMERLESS GUNS,

## EXPRESS RIFLES,

## REVOLVERS,

## AMMUNITION,

AND

## MILITARY ARMS OF ALL KINDS.

PRICE LIST ON APPLICATION.

---

The Central-fire System in general use, was invented and patented by Mr. DAW in 1861. Since the "Daw" System obtained the PRIZE MEDAL at the INTERNATIONAL EXHIBITION of 1862, it has superseded all other Inventions.

Mr. DAW was the Inventor and Patentee of the Government Prize Cartridge, and obtained the £400 Award, and is also the inventor of many Valuable improvements in Fire Arms and ammunition used by the present generation of Sportsmen and by the English and Foreign Governments. Prize Medals awarded to Mr. Daw for his Inventions at the leading International Exhibitions.

---

**Established 1780.**

---

**ALTERATIONS OR REPAIRS**

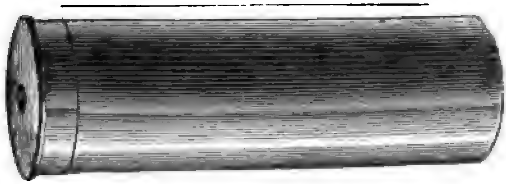
to any description of Guns, Rifles, or Revolvers, carefully and promptly executed at Moderate Charges.


# KYNOCH & CO.,

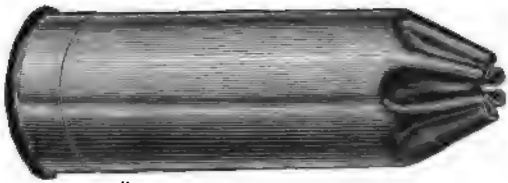
## AMMUNITION MANUFACTURERS.

**MILITARY & SPORTING CARTRIDGES OF EVERY KIND.**

**PERCUSSION CAPS & WADDINGS. FOG SIGNALS FOR RAILWAYS.**



**"PERFECT" CASE EMPTY.**



**"PERFECT" CASE LOADED.**

## KYNOCH'S PATENT "PERFECT"

**Central Fire and Pin Fire, 8, 10, 12, 14, 16, 20, 24, 28, ·410, and ·360 BORE**

## METALLIC CARTRIDGE.

## NOTICE.

KYNOCH & CO. request buyers of the "Perfect" Cartridges to observe the new and effectual style of closing. It is impossible, under any circumstances, for the shot to get loose, or the wad to be displaced. Buyers of the No. 1 Crimper can have the Tool (necessary to complete the closing) gratis on application direct to our Works, at Witton, or from any of our Agents.

MISSFIRES having been found in some guns with weak springs, or imperfect locks, K. and Co. have now made the alterations necessary, and will guarantee that any gun in which the old paper cartridge can be used will answer for the "Perfect."

To show the advantage of the "Perfects" in guns made specially, we have a 28-bore gun (we will show to any one interested) which will hit and pierce an ordinary powder canister at 75 yards, the charge being only 2¾ drams of powder, and ¾ of an ounce of No. 4 shot. Guns of other bores, showing equally important improvements, may also be seen.

**KYNOCH'S Patent Gas-tight Green and Salmon (for Schultze Powder; also Blue and Brown PAPER SPORTING CARTRIDGES in every size.**

**KYNOCH'S NICKEL-PLATED SPORTING CARTRIDGES.**
**KYNOCH'S SOLID METAL MARTINI-HENRY CARTRIDGES.**
**KYNOCH'S SOLID METAL EXPRESS CARTRIDGES.**
**KYNOCH'S SOLID METAL AND PAPER PUNT GUN CARTRIDGES.**
**KYNOCH'S ROOK RIFLE CARTRIDGES.**
**KYNOCH'S REVOLVER CARTRIDGES.**

Illustrated Catalogue, Price List, and Samples forwarded to Merchants or Gunmakers on application to

**KYNOCH & CO., WITTON, Near BIRMINGHAM.**

# A BOON TO TRAVELLERS.

## THE "CARMICHAEL"

# PORTABLE TREES.


LONG TREES, Price 38s. SHORT TREES, 27s.

**"PLANTAGENET" OF THE "FIELD," DEC. 17, SAYS**

**OF**

## THE "CARMICHAEL" PORTABLE TREES.

"Finding that it was absolutely necessary, in moving quickly from place to place, to try some substitute for the old cumbersome wooden trees, I determined to test what had hitherto been looked upon as a fanciful toy. As so often happens, the toy turns out to possess unthought-of advantages. The "CARMICHAEL" TREES may be carried wherever boots can, for they take up no more room, and add no appreciable weight."

# W. SPARKES HALL & CO.,

## BOOTMAKERS,

By appointment to H.R.H. the Prince of Wales, H.R.H. the Duke of Connaught, H.R.H. Prince Christian,

**308 & 310, REGENT STREET, LONDON, W.**

(NEAR THE LANGHAM HOTEL).

**First Class Award International Medical and Sanitary Exhibition, 1881, for Portable Turkish, Hot-Air, and Vapour Bath, Bronchitis and Croup Kettles.**

# A TURKISH BATH

## IN YOUR OWN ROOM.

TO THE STALWART A LUXURY.

AFTER HUNTING, DRIVING, SHOOTING, FISHING, RIDING, OR ANY EXCESSIVE FATIGUE.

TO THE INVALID A NECESSITY.

FOR RHEUMATISM, GOUT, LUMBAGO, SCIATICA, ECZEMA, AND SKIN, LIVER, AND KIDNEY AFFECTIONS.

**CAN ALSO BE APPLIED TO BED.**

**CAN BE USED FOR HOT AIR OR VAPOUR.**

Apparatus for use Under Chair, with Best Cloak, Tinned Iron Supports, in box, 50s. Apparatus only, 22s. 6d.

Apparatus for Bed, in box, with pair of Wicker Frames, 45s.

---

**The *Lancet* says :—" This instrument is very complete. It is portable, it is cheap, and it acts promptly."**

***Sanitary Record* says : " Will be found a luxury, as well as a valuable remedial resource."**

***Medical Examiner* says : " Such a contrivance as Allen and Son's Portable Turkish Baths should find a place in every well regulated household."**

---

**Sole Inventors and Manufacturers,**

# JAMES ALLEN AND SON,

**21 & 23, MARYLEBONE LANE, LONDON, W.**

**ALSO MAKERS OF BRONCHITIS KETTLES, INVALIDS' BATHS, &c.**

**Illustrated Catalogue post free for 3 stamps.**

# BENJAMIN EDGINGTON,

## MARQUEE, TENT, RICK CLOTH, AND FLAG MANUFACTURER,

By Special Appointment to the Queen and Prince of Wales,

## 2, DUKE STREET, LONDON BRIDGE, S.E.

**(Opposite the Railway Station.)**

SQUARE TENT FOR THE MOORS.

**For Shooting or Fishing Expeditions the Square Tent is perhaps the most convenient, the Walls being 6 feet high.**

**THE WHOLE INTERIOR SPACE IS AVAILABLE.**

**There is a complete inner lining and convenience for slinging a Cot or Hammock.**

**Extract from "Hints to Missionaries Travelling in Africa,"**

By Dr Sothern, London Missionary Society, 1880.

"Nothing can be better suited to the requirements of an expedition than the excellent tents supplied us by Mr Benjamin Edgington, of London Bridge. They were made especially to order, and of different material to that generally used for Tents. I heartily recommend them."

---

## "WILLESDEN" Patent Prepared

## WATER-REPELLENT ROT-PROOF COPPER CANVAS

**For Covers, Awnings, Sails, Blinds, and the numberless other uses for which a pliable Waterproof Canvas is required.**

---

Write for Samples to

## 2, DUKE STREET, LONDON BRIDGE, S.E.

ONLY ONE ADDRESS; and to prevent mistakes the Full Christian Name must be Written.